

HP StorageWorks Modular Smart Array 500 Generation 2 Storage System User Guide



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Part Number 354906-002

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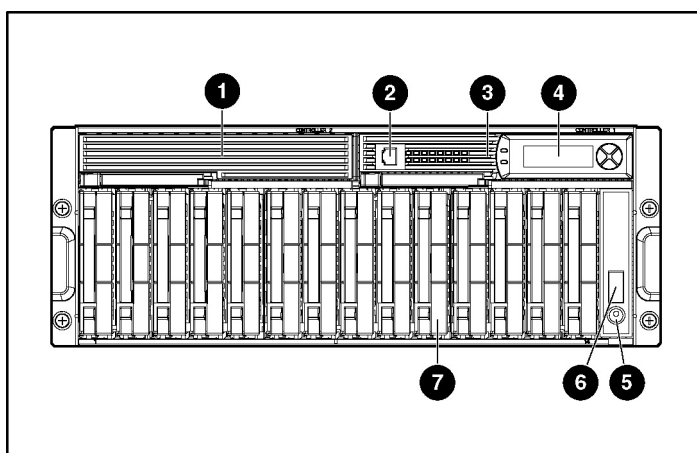
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Component identification

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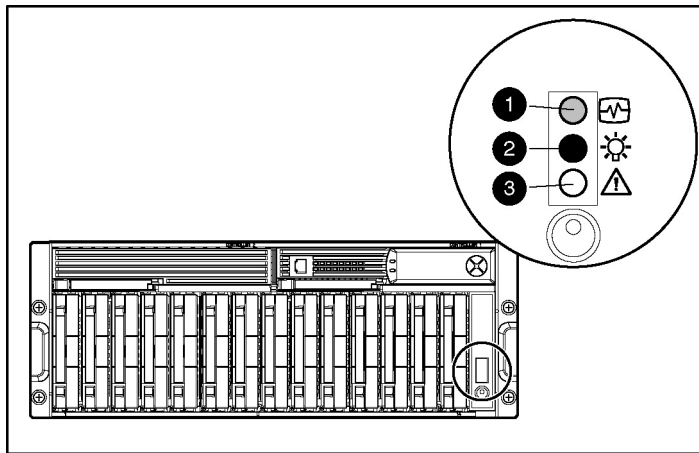
Front panel components



| Item | Description |
|------|--|
| 1 | Bezel blank (bay for optional redundant controller) |
| 2 | Service port (for HP service technicians only) |
| 3 | Hot-plug HP StorageWorks Modular Smart Array 500 Generation 2 controller |

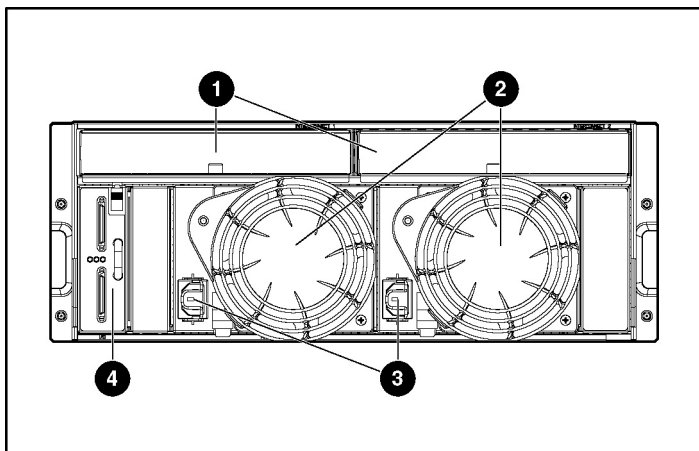
| Item | Description |
|------|---|
| 4 | Controller display |
| 5 | Power On/Standby button |
| 6 | Enclosure LEDs |
| 7 | Hot-plug SCSI hard drive bays with blanks |

Enclosure LEDs



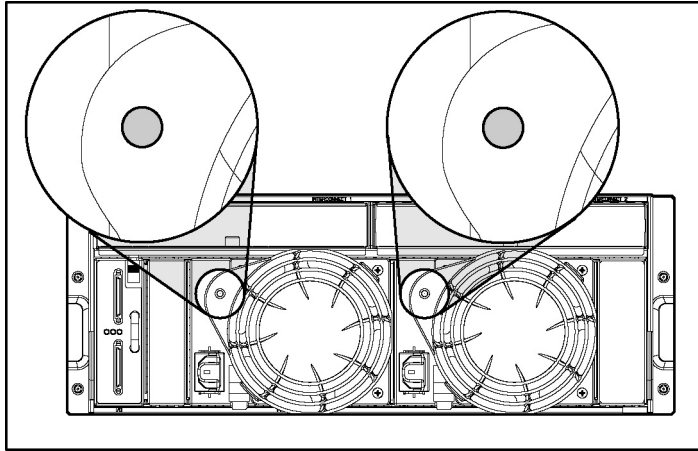
| Item | Description | Status |
|------|---------------|---|
| 1 | EMU heartbeat | Green flashing = Shared storage module is operating normally. Green/Off = Shared storage module is not operating normally. |
| 2 | System power | Green = System power is On. Off = System is in standby mode or power is removed from the system. |
| 3 | Fault | Amber = Fault is detected in a subsystem. Off = No faults are detected. |

Rear panel components



| Item | Description |
|------|---|
| 1 | Interconnect blanks (required for proper airflow) |
| 2 | Power supply/blower assemblies |
| 3 | AC power connectors |
| 4 | 2-Port Shared Storage Module |

Power supply/blower assembly LEDs



The power supply/blower assembly LEDs have two functions:

- Green—The power supply is receiving power, and the blower is operating normally.
- Off—No power is present; the power supply or the blower has failed.

Shared Storage Module with integrated environmental monitoring unit

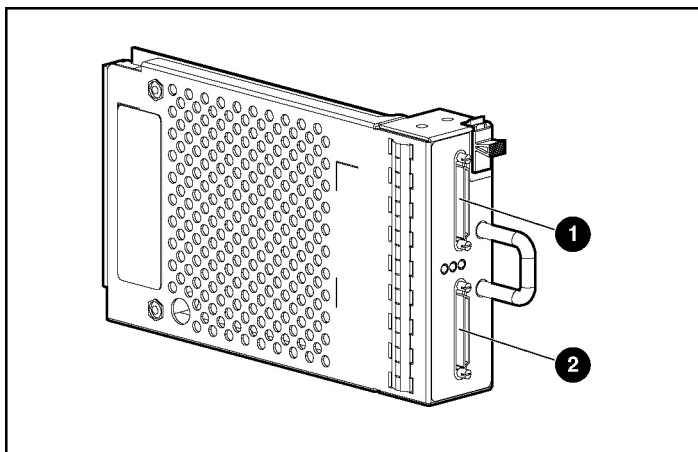
The storage system supports multipath two-node clustering and up to four-node shared storage with Ultra320 SCSI I/O hardware. The storage system ships standard with the 2-Port Shared Storage Module. A 4-Port Shared Storage Module is available as an option.

Functions include:

- Provides the interconnect function to the server nodes
- Monitors the enclosure operation for:
 - Temperature
 - Power supplies

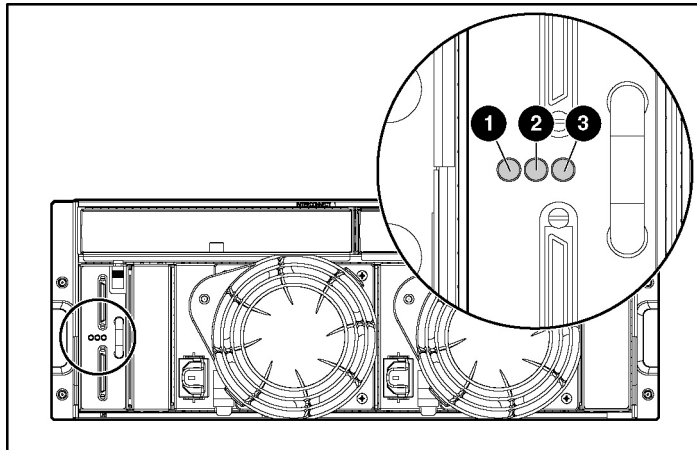
- Blowers
- Drive presence
- Detects and reports component changes in the enclosure (identifies hot-plug addition and removal)
- Controls drive and enclosure LEDs

2-Port Shared Storage Module Components



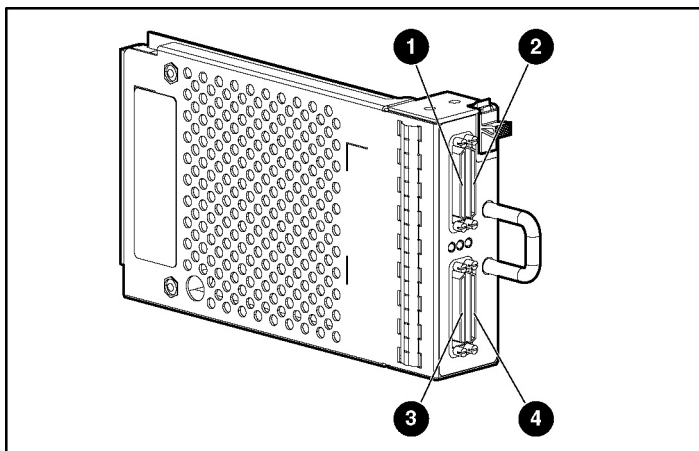
| Item | Description | Bus |
|------|---------------------|-----|
| 1 | SCSI port connector | A |
| 2 | SCSI port connector | B |

2-Port Shared Storage Module LEDs



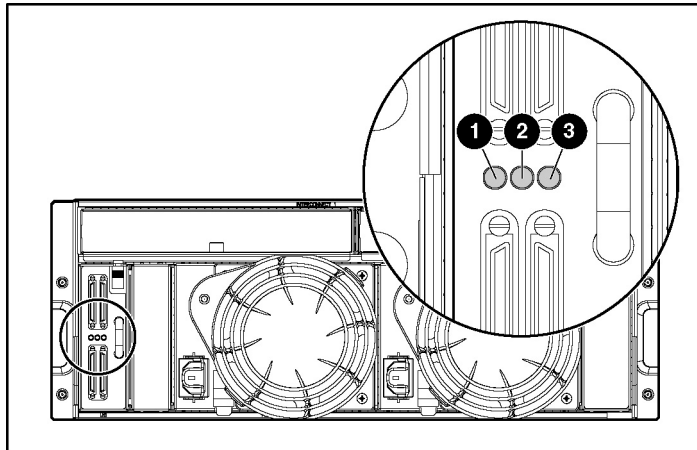
| Item | LED Description | Status |
|------|------------------|--|
| 1 | Power | Flashing green = Power on Off = Power off |
| 2 | SCSI host port A | Flashing green = On/Activity Off = Off |
| 3 | SCSI host port B | Flashing green = On/Activity Off = Off |

4-Port Shared Storage Module Components



| Item | Description | Bus |
|------|------------------------|-----|
| 1 | SCSI port connector A1 | A |
| 2 | SCSI port connector A2 | A |
| 3 | SCSI port connector B1 | B |
| 4 | SCSI port connector B2 | B |

4-Port Shared Storage Module LEDs



| Item | LED Description | Status |
|------|--|--|
| 1 | Power | Flashing green = Power on Off = Power off |
| 2 | SCSI host port A connectors 1 and 2 | Flashing green = On/Activity Off = Off |
| 3 | SCSI host port B connectors 1 and 2 | Flashing green = On/Activity Off = Off |

Controller components

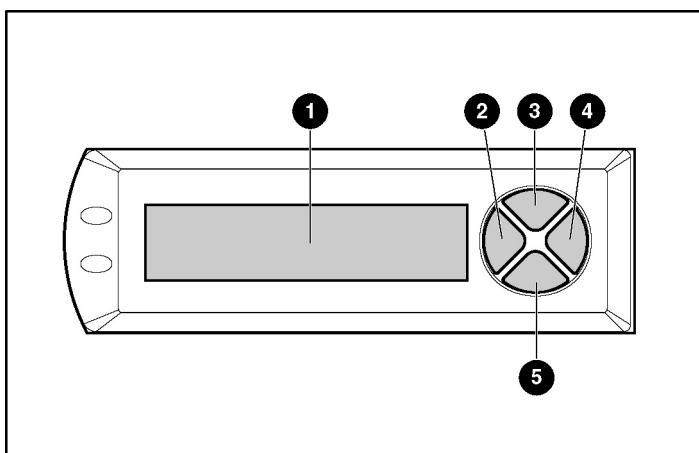
Controller Display (on page [19](#))

Controller LEDs (on page [20](#))

Battery-Backed Write Cache Enabler Overview (on page [21](#))

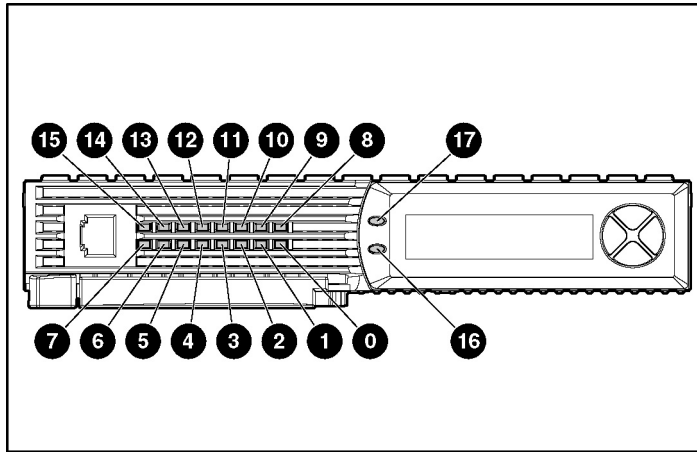
Controller display

Each controller LCD provides informational and error messages.



| Item | Description |
|------|--------------|
| 1 | Display |
| 2 | Left button |
| 3 | Up button |
| 4 | Right button |
| 5 | Down button |

Controller LEDs



| Item | LED Description | Status |
|------|--------------------------|---|
| 0-2 | Busy status | Green = Controller is idle. Off = Controller is operating at full capacity. |
| 3-5 | No function | — |
| 6 | Host port A notification | Green = Notify On Event command is active. Off = No Notify On Event command is active. |
| 7 | Host port B notification | Green = Notify On Event command is active. Off = No Notify On Event command is active. |
| 8 | Idle heartbeat | Controller is idle and functioning. |
| 9 | Active/Standby | Green = Controller is active. Off = Controller is in standby. |
| 10 | DMA activity | Green = DMA transfers are active. Off = No DMA transfers are active. |

| Item | LED Description | Status |
|------|----------------------|--|
| 11 | Logical I/O activity | Green = System is currently processing logical requests from the host adapter. Off = System is not processing any logical requests. |
| 12 | SCSI bus 0 activity | Green = Outstanding requests exist on the SCSI bus. Off = No outstanding requests exist. |
| 13 | SCSI bus 1 activity | Green = Outstanding requests exist on the SCSI bus. Off = No outstanding requests exist. |
| 14 | Cache activity | Green = Cache activity is present. Off = No cache activity is present. Flashing green = Cache transfer is pending. |
| 15 | Drive failure | Green = An array-configured drive has failed. Off = No drives have failed. |
| 16 | Active redundancy | Green = Controllers are operating with redundancy. Off = No redundancy exists. |
| 17 | Fault | Amber = Error message has been received by the controller display. Off = No error message has been received or no error message is displayed currently. |

Battery-Backed Write Cache Enabler Overview

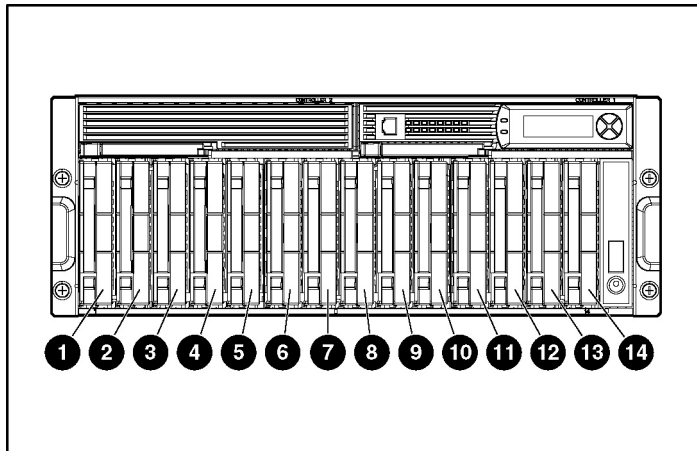
The Battery-Backed Write Cache Enabler, also known as the battery module, provides transportable data protection, increases overall controller performance, and maintains any cached data for up to 72 hours. The NiMH batteries in the battery module are continuously recharged through a trickle-charging process whenever the system power is on. Under normal operating conditions, the battery module lasts for 3 years before replacement is necessary.

NOTE: The data protection and the time limit also apply if a power outage occurs. When power is restored to the system, an initialization process writes the preserved data to the hard drives.

To enable faster data access from disk storage, the battery module performs two types of caching:

- Posted-write caching—the controller writes user data in the cache memory on the module rather than directly to the drives. Later, when the storage system is idle, the controller writes the data to the drive array.
- Read-ahead caching—the controller detects sequential array access, reads ahead into the next sequence of data, and stores the data in the read-ahead cache. Then, if the next read access is for the cached data, the controller immediately loads the data into system memory, avoiding the latency of a disk access.

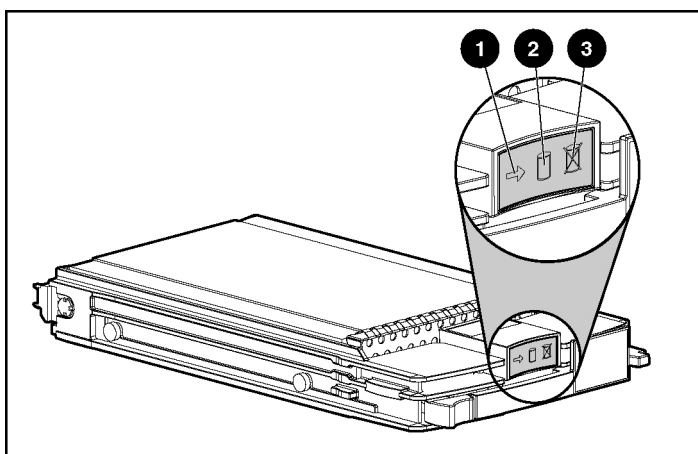
SCSI IDs



| Bay | SCSI ID | Bus Port |
|-----|---------|----------|
| 1 | 0 | 0 |
| 2 | 1 | 0 |
| 3 | 2 | 0 |
| 4 | 3 | 0 |

| Bay | SCSI ID | Bus Port |
|-----|---------|----------|
| 5 | 4 | 0 |
| 6 | 5 | 0 |
| 7 | 8 | 0 |
| 8 | 0 | 1 |
| 9 | 1 | 1 |
| 10 | 2 | 1 |
| 11 | 3 | 1 |
| 12 | 4 | 1 |
| 13 | 5 | 1 |
| 14 | 8 | 1 |

Hot-plug SCSI hard drive LEDs



| Item | LED description | Status |
|------|-----------------|---|
| 1 | Activity status | On = Drive activity Flashing = High activity on the drive or drive is being configured as part of an array. Off = No drive activity |

| Item | LED description | Status |
|------|-----------------|---|
| 2 | Online status | On = Drive is part of an array and is currently working. Flashing = Drive is actively online. Off = Drive is offline. |
| 3 | Fault status | On = Drive failure Flashing = Fault-process activity Off = No fault-process activity |

Hot-plug SCSI hard drive LED combinations

| Activity LED (1) | Online LED (2) | Fault LED (3) | Interpretation |
|----------------------|----------------|---------------|--|
| On, off, or flashing | On or off | Flashing | A predictive failure alert has been received for this drive. Replace the drive as soon as possible. |
| On, off, or flashing | On | Off | The drive is online and is configured as part of an array. If the array is configured for fault tolerance and all other drives in the array are online, and a predictive failure alert is received or a drive capacity upgrade is in progress, you may replace the drive online. |
| On or flashing | Flashing | Off | Do not remove the drive. Removing a drive may terminate the current operation and cause data loss. The drive is rebuilding or undergoing capacity expansion. |
| On | Off | Off | Do not remove the drive. The drive is being accessed, but (1) it is not configured as part of an array; (2) it is a replacement drive and rebuild has not yet started; or (3) it is spinning up during the POST sequence. |
| Flashing | Flashing | Flashing | Do not remove the drive. Removing a drive may cause data loss in non-fault-tolerant configurations. Either (1) the drive is part of an array being selected by an array configuration utility; (2) Drive Identification has been selected in HP SIM; or (3) drive firmware is being updated. |
| Off | Off | On | The drive has failed and has been placed offline. You may replace the drive. |

| Activity LED (1) | Online LED (2) | Fault LED (3) | Interpretation |
|------------------|----------------|---------------|--|
| Off | Off | Off | <p>Either (1) the drive is not configured as part of an array; (2) the drive is configured as part of an array, but it is a replacement drive that is not being accessed or being rebuilt yet; or (3) the drive is configured as an online spare.</p> <p>If the drive is connected to an array controller, you may replace the drive online.</p> |

Operations

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Power up the storage system

Observe the following guidelines before powering up the storage system:

- Be sure that all components are powered down.
- Always install all components of the storage system and connect components to the supported interconnect options.
- Install hard drives in the storage system so the controller can identify and configure them at power up.



CAUTION: You must power up the storage system before powering up the servers. It may take up to 2 minutes for the storage system to completely power up. Wait until the display provides the *Startup Complete* message.

To power up the storage system:

1. Complete server hardware installation and cabling. Refer to the server documentation.
2. Connect the SCSI cables and power cords to the storage system.
3. Press the Power On/Standby button.

Wait and observe the system power LED and controller display. When the storage system goes from standby to full power, the system power LED illuminates solid green, and the display provides a *Startup Complete* message.

4. Power up the servers. Refer to the server documentation.

Power down the storage system



WARNING: To reduce the risk of personal injury, electric shock, or damage to the equipment, remove the power cord to remove power from the storage system. The front panel Power On/Standby button does not completely shut off system power. Portions of the power supply and some internal circuitry remain active until AC power is removed.



CAUTION: In systems that use external data storage, be sure that the server is the first unit to be powered down and the last to be powered back up. Taking this precaution ensures that the system does not erroneously mark the drives as failed when the server is powered up.

IMPORTANT: If installing a hot-plug device, it is not necessary to power down the storage system.

1. Power down any attached servers. Refer to the server documentation.
2. Press the Power On/Standby button on the storage system. Wait for the system power LED to go from green to off.
3. Disconnect the power cords.

The system is now without power.

Use the controller display

Each MSA500 G2 controller in the MSA500 G2 storage system contains an integrated LCD. This module displays informational and error messages, shows the current status of the module, and provides an interface for user input. The storage system combines traditional POST messages issued by PCI-based array controllers with runtime event notification messages for this new set of controller display messages.

The display module consists of the following components:

- A two-line, 20-column display text window
- Four buttons

- Two LEDs

Types of messages

The display module is capable of storing up to 100 messages. When the message log is full, the system deletes the oldest message to make room for the most recent one.

The types of messages include:

- **Error Messages**—Error messages indicate a problem that may require user action.

The Fault LED illuminates when you view an error message. It also illuminates to indicate that an unviewed error message is in the queue and was followed by other types of messages. When scrolling backward to view all error messages, the LED illuminates only when an error message is in the text display window.

- **Informational Messages**—Informational messages provide feedback on non-critical changes.
- **User Input Messages**—User input messages indicate an issue that requires a choice. The user can choose a selection before the end of a time-out period or allow the controller to default to a standard choice. User input messages only occur during system power up.

The Fault LED flashes when a user input message is in the text display window and requires input. If the user does not provide input within the time-out period, the message remains, but the LED stops flashing.

A complete list of error messages is available ("Display messages" on page [85](#)).

Using the interface

- **Scrolling**—To view older messages, scroll backward with the **Up** button (indicated by the up arrow). To view newer messages, scroll forward with the **Down** button (indicated by the down arrow).

The arrival of new messages supersedes the display of any previous messages. When a new message arrives, the display ignores its previous scrolling position and presents the new message.

- **Selecting User Input Options**—User input messages present the user with a choice and define the options in the text display window. Select one of the options by pushing the **Left** button (indicated by the left arrow) or the **Right** button (indicated by the right arrow).
- **Deleting Messages**—To delete a message, scroll to the message, then press the **Left** and **Right** buttons simultaneously.

Setup

In this section

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Rack planning resources

The rack resource kit ships with all HP branded or Compaq branded 9000, 10000, and H9 series racks. A summary of the content of each resource follows:

- Custom Builder is a web-based service for configuring one or many racks. Rack configurations can be created using:
 - A simple, guided interface
 - Build-it-yourself mode

For more information, refer to the HP website (<http://www.hp.com/products/configurator>).
- The Installing Rack Products video provides a visual overview of operations required for configuring a rack with rack-mountable components. It also provides the following important configuration steps:
 - Planning the site
 - Installing rack servers and rack options

- Cabling servers in a rack
- Coupling multiple racks
- The Rack Products Documentation CD enables you to view, search, and print documentation for HP and Compaq branded racks and rack options. It also helps you set up and optimize a rack in a manner that best fits your environment.

If you intend to deploy and configure multiple servers in a single rack, refer to the white paper on high-density deployment on the HP website (<http://www.hp.com/products/servers/platforms>).

Optimum environment

When installing the storage system in a rack, select a location that meets the environmental standards described in this section.

Space and airflow requirements

To allow for servicing and adequate airflow, observe the following space and airflow requirements when deciding where to install a rack:

- Leave a minimum clearance of 63.5 cm (25 in) in front of the rack.
- Leave a minimum clearance of 76.2 cm (30 in) behind the rack.
- Leave a minimum clearance of 121.9 cm (48 in) from the back of the rack to the back of another rack or row of racks.

HP storage systems draw in cool air through the front door and expel warm air through the rear door. Therefore, the front and rear rack doors must be adequately ventilated to allow ambient room air to enter the cabinet, and the rear door must be adequately ventilated to allow the warm air to escape from the cabinet.



CAUTION: To prevent improper cooling and damage to the equipment, do not block the ventilation openings.

When a vertical space in the rack is not filled by a server or rack component, the gaps between the components cause changes in airflow through the rack and across the servers. Cover all gaps with blanking panels to maintain proper airflow.



CAUTION: Always use blanking panels to fill empty vertical spaces in the rack. This arrangement ensures proper airflow. Using a rack without blanking panels results in improper cooling that can lead to thermal damage.

The 9000 and 10000 Series racks provide proper server cooling from flow-through perforations in the front and rear doors that provide 64 percent open area for ventilation.



CAUTION: When using a Compaq branded 7000 Series rack, you must install the high airflow rack door insert [P/N 327281-B21 (42U) or P/N 157847-B21 (22U)] to provide proper front-to-back airflow and cooling.



CAUTION: If a third-party rack is used, observe the following additional requirements to ensure adequate airflow and to prevent damage to the equipment:

- Front and rear doors—If the 42U rack includes closing front and rear doors, you must allow 5,350 sq cm (830 sq in) of holes evenly distributed from top to bottom to permit adequate airflow (equivalent to the required 64 percent open area for ventilation).
- Side—The clearance between the installed rack component and the side panels of the rack must be a minimum of 7 cm (2.75 in).

Temperature requirements

To ensure continued safe and reliable equipment operation, install or position the storage system in a well-ventilated, climate-controlled environment.

The maximum TMRA for most storage system products is 35°C (95°F). The temperature in the room where the rack is located must not exceed 35°C (95°F).



CAUTION: To reduce the risk of damage to the equipment when installing third-party options:

- Do not permit optional equipment to impede airflow around the storage system or to increase the internal rack temperature beyond the maximum allowable limits.
- Do not exceed the manufacturer's TMRA.

Power requirements

Installation of this equipment must comply with local and regional electrical regulations governing the installation of information technology equipment by licensed electricians. This equipment is designed to operate in installations covered by NFPA 70, 1999 Edition (National Electric Code) and NFPA-75, 1992 (code for Protection of Electronic Computer/Data Processing Equipment). For electrical power ratings on options, refer to the product rating label or the user documentation supplied with that option.



WARNING: To reduce the risk of personal injury, fire, or damage to the equipment, do not overload the AC supply branch circuit that provides power to the rack. Consult the electrical authority having jurisdiction over wiring and installation requirements of your facility.



CAUTION: Protect the storage system from power fluctuations and temporary interruptions with a regulating UPS. This device protects the hardware from damage caused by power surges and voltage spikes and keeps the storage system in operation during a power failure.

When installing more than one storage system, you may need to use additional power distribution devices to safely provide power to all devices. Observe the following guidelines:

- Balance the storage system power load between available AC supply branch circuits.
- Do not allow the overall system AC current load to exceed 80 percent of the branch circuit AC current rating.
- Do not use common power outlet strips for this equipment.

- Provide a separate electrical circuit for the storage system.

Electrical grounding requirements

The storage system must be grounded properly for proper operation and safety. In the United States, you must install the equipment in accordance with NFPA 70, 1999 Edition (National Electric Code), Article 250, as well as any local and regional building codes. In Canada, you must install the equipment in accordance with Canadian Standards Association, CSA C22.1, Canadian Electrical Code. In all other countries, you must install the equipment in accordance with any regional or national electrical wiring codes, such as the International Electrotechnical Commission (IEC) Code 364, parts 1 through 7. Furthermore, you must be sure that all power distribution devices used in the installation, such as branch wiring and receptacles, are listed or certified grounding-type devices.

Because of the high ground-leakage currents associated with multiple storage system connected to the same power source, HP recommends the use of a power distribution unit (PDU) that is either permanently wired to the building's branch circuit or includes a nondetachable cord that is wired to an industrial-style plug. NEMA locking-style plugs or those complying with IEC 60309 are considered suitable for this purpose. Using common power outlet strips for the storage system is not recommended.

Rack warnings



WARNING: To reduce the risk of personal injury or damage to the equipment, be sure that:

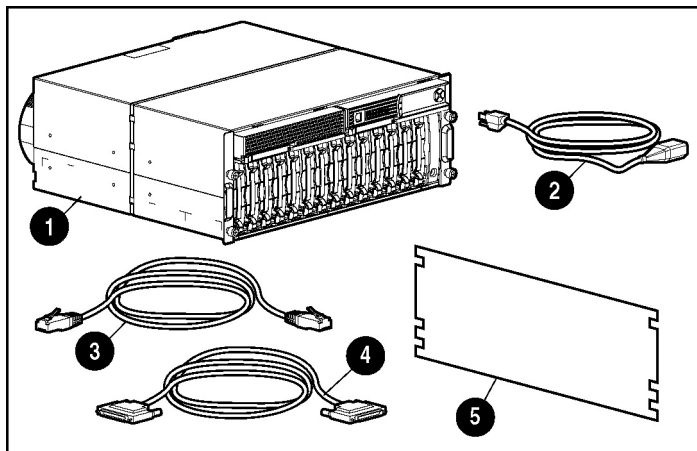
- The leveling jacks are extended to the floor.
- The full weight of the rack rests on the leveling jacks.
- The stabilizing feet are attached to the rack if it is a single-rack installation.
- The racks are coupled together in multiple-rack installations.
- Only one component is extended at a time. A rack may become unstable if more than one component is extended for any reason.



WARNING: To reduce the risk of personal injury or equipment damage when unloading a rack:

- At least two people are needed to safely unload the rack from the pallet. An empty 42U rack can weigh as much as 115 kg (253 lb), can stand more than 2.1 m (7 ft) tall, and may become unstable when being moved on its casters.
- Never stand in front of the rack when it is rolling down the ramp from the pallet. Always handle the rack from both sides.

Shipping contents



| Item | Description |
|------|--|
| 1 | MSA500 G2 storage system |
| 2 | Power cords (2) |
| 3 | Ethernet crossover cable |
| 4 | SCSI VHDCI cables (2) |
| 5 | 4U rack template |
| 6 | Rack mounting hardware kit (not shown) |
| 7 | Smart Array 642 adapter (2, not shown) |
| 8 | Documentation set (not shown) |

NOTE: The ethernet crossover cable is for Microsoft® and Linux operating systems only.

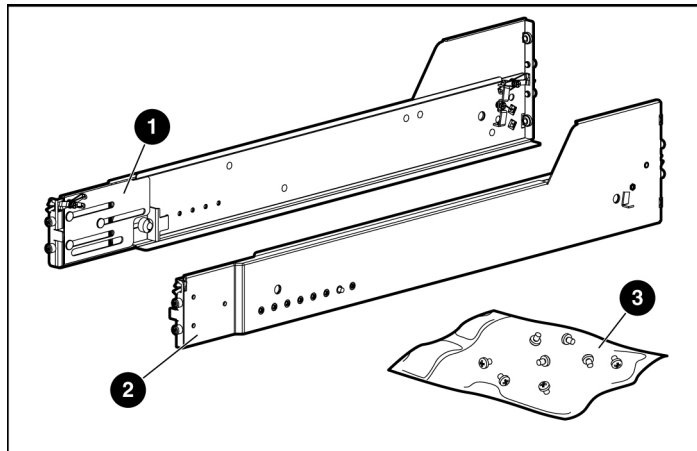
In addition to these supplied items, you may need:

- Application software diskettes
- Options to be installed
- No. 2 Phillips screwdriver

Rack mounting hardware kit contents

The rack mounting hardware kit provides the required components for quick deployment in Compaq branded, HP branded, and most square- and round-hole third-party racks. The adjustable feature of the rack rails enables installation in racks with depths of 69.90 to 76.2 cm (27.52 to 30.00 in).

If you are installing the MSA500 G2 storage system in an M-Series rack, contact an authorized reseller to obtain an M-Series Rack Rail option kit.



| Item | Description |
|------|---|
| 1 | Rack rail (left) |
| 2 | Rack rail (right) |
| 3 | Pins for round-hole rack conversion (8) |

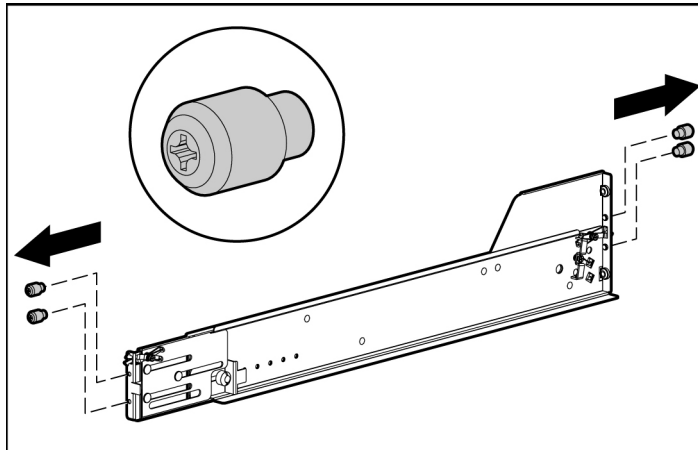
In addition to these supplied items, you may need a No. 2 Phillips screwdriver.

Converting rails for round-hole racks

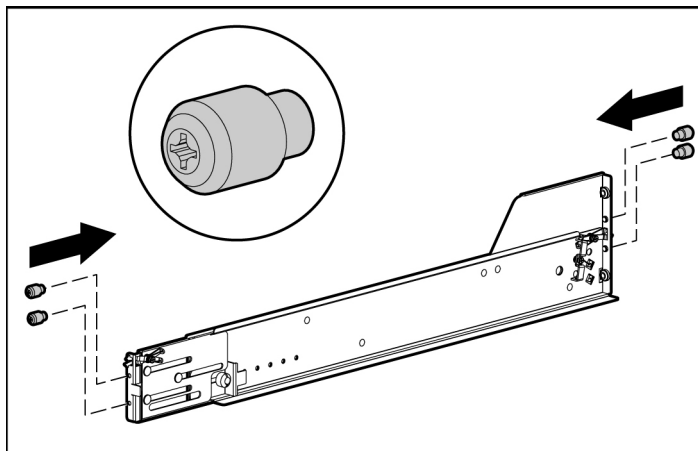
The rack rails ship configured for square-hole racks. To convert the rack rails for use in a round-hole rack:

1. Locate the bag of miscellaneous hardware that ships with the rack rails.
2. Locate the eight round-hole pins.

3. Use a No. 2 Phillips screwdriver to remove the standard pins from the front and back ends of the rail.



4. Install four round-hole pins into the rail.



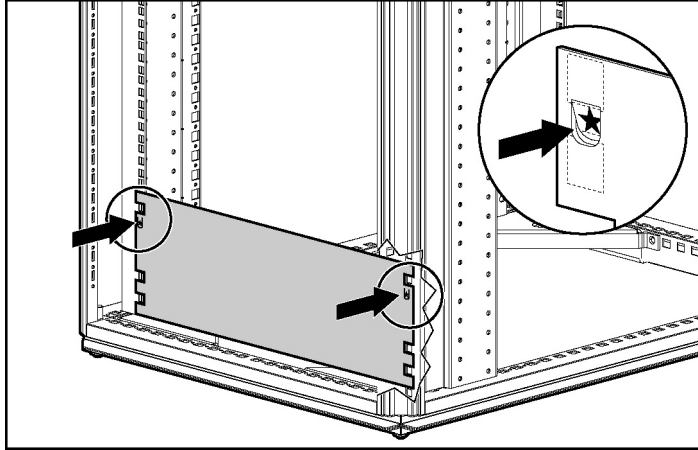
5. Repeat steps 3 and 4 for the second rail.

Installing a storage system into the rack

1. Mark the rack.



CAUTION: Always plan the rack installation so that the heaviest item is on the bottom of the rack. Install the heaviest item first, and continue to populate the rack from the bottom to the top.



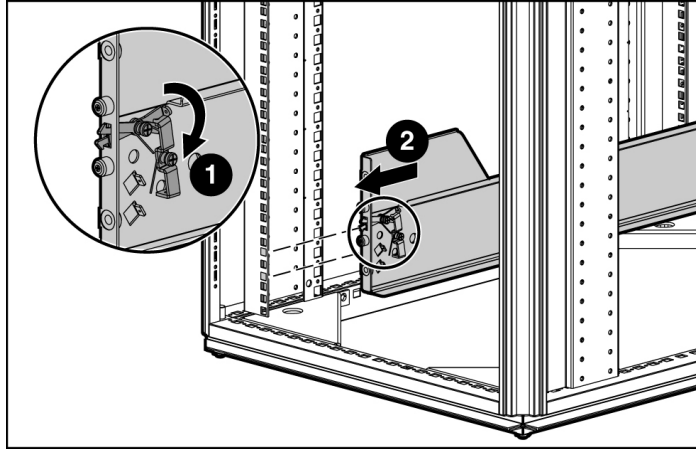
NOTE: Rack components are removed for clarity.

2. Secure the front end of the rails to the rack.

IMPORTANT: Do not remove the pins from the ends of the rack rails unless you are converting the rails for use in round-hole racks. These load-bearing pins are designed to fit through the holes without being removed.

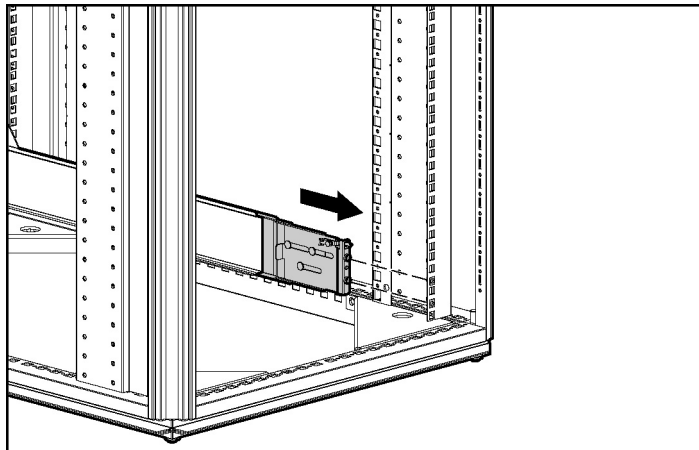
IMPORTANT: Be sure that the scissor-type locking latches engage the rack fully when the pins extend through the holes marked with the template.

NOTE: Identify the left (L) and right (R) rack rails by markings stamped into the sheet metal.



3. Secure the back end of the rails to the rack.

IMPORTANT: Be sure that the scissor-type locking latches engage the rack fully when the pins extend through the holes marked with the template.

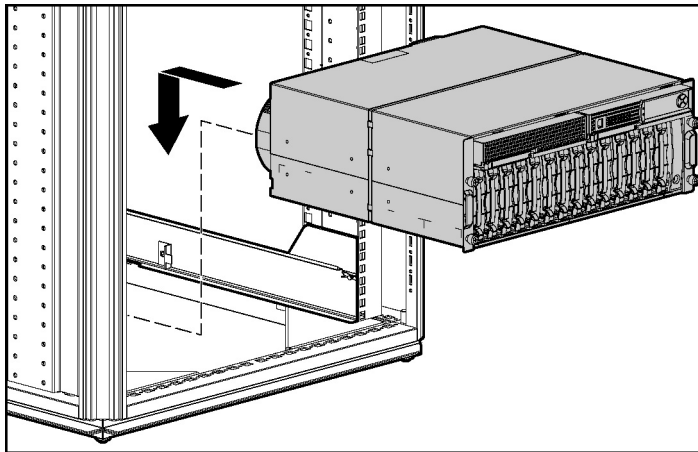


4. With one person on each side, lift the chassis to rail level and slide the chassis on the mounting rails.

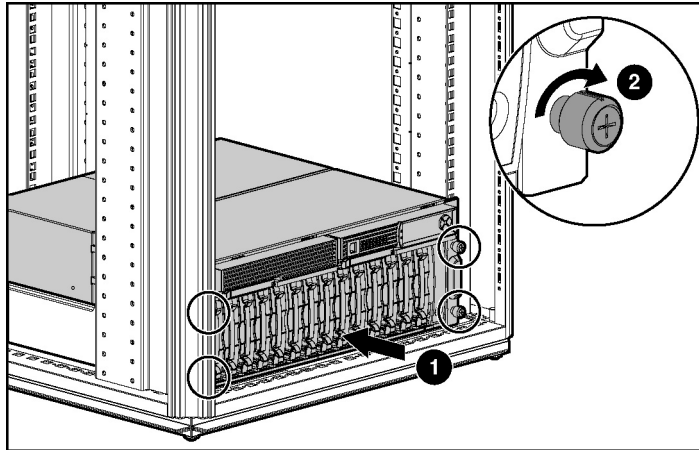


WARNING: This storage system is very heavy. To reduce the risk of personal injury or damage to the equipment:

- Observe local occupational health and safety requirements and guidelines for manual material handling.
- Get help to lift and stabilize the product during installation or removal, especially when the product is not fastened to the rails. When the storage system weighs more than 22.5 kg (50 lb), at least two people must lift the storage system into the rack together. If the storage system is loaded into the rack above chest level, a third person must assist in aligning the rails while the other two support the storage system.
- Use caution when installing the storage system in or removing the storage system from the rack; it is unstable when not fastened to the rails.



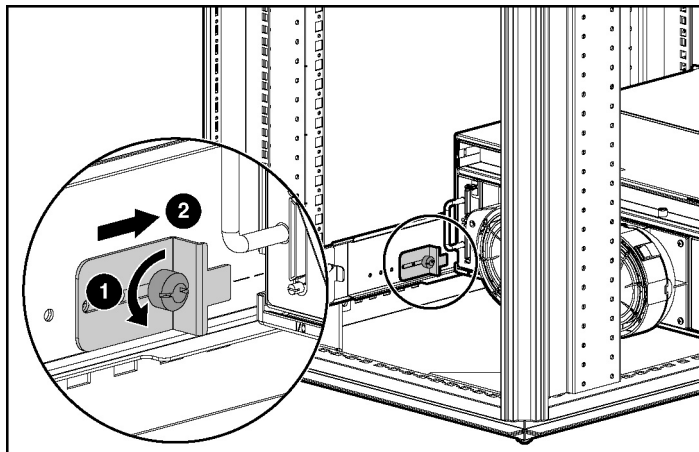
5. Secure the chassis to the rack.



6. Use the shipping bracket to secure the storage system for shipping:

IMPORTANT: Use of the shipping bracket is required only when the rack is shipped with the MSA500 G2 storage system installed.

- a. Loosen the thumbscrew on the shipping bracket.
- b. Slide the shipping bracket forward until it engages the chassis.



- c. Tighten the thumbscrew.

Installing hardware options

Install any hardware options before initializing the storage system. For options installation information, refer to the option documentation. For storage system-specific information, refer to "Hardware Options Installation (on page [49](#))."

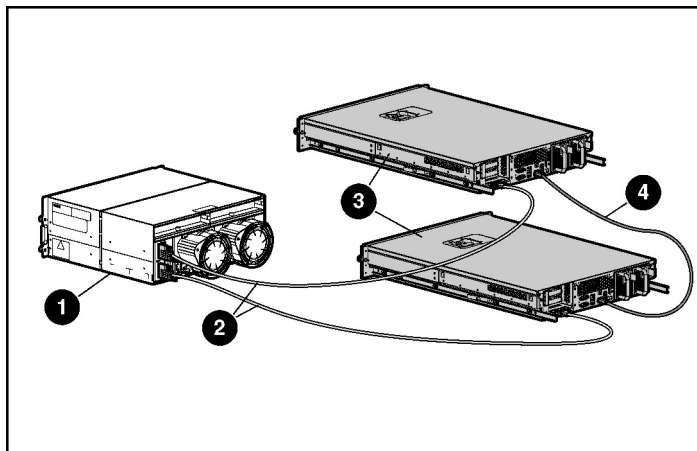
Installing servers

Install the servers in the rack directly above the storage system. Refer to the server documentation.

Choosing a configuration

Cable procedures vary depending on the DAS, SSP, or multipath configuration. Choose one of the following configurations.

Clustering configuration

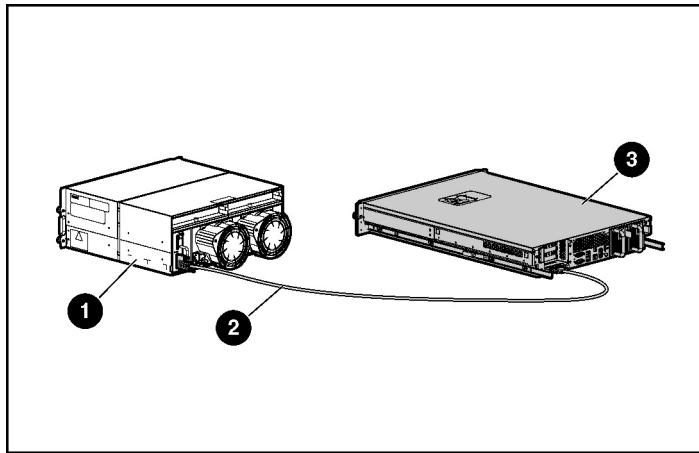


| Item | Description |
|------|--------------------------|
| 1 | MSA500 G2 storage system |
| 2 | VHDCI SCSI cables |

| Item | Description |
|------|--------------------------|
| 3 | Servers |
| 4 | Ethernet crossover cable |

NOTE: The ethernet crossover cable is for Microsoft® and Linux operating systems only.

Single-server configuration



| Item | Description |
|------|--------------------------|
| 1 | MSA500 G2 storage system |
| 2 | VHDCI SCSI cable |
| 3 | Server |

SSP hardware configurations

To configure the hardware for SSP, use SCSI cables to connect each server to the 2-Port or 4-Port Shared Storage Module installed in the storage system. Boot volumes for individual servers can reside on server drives or storage system drives.

After choosing the configuration that best suits your needs, enable SSP with ACU Version 7.10 or later. Locate ACU on the SmartStart CD. For instructions, refer to the *HP Array Configuration Utility User Guide* on the Documentation CD.

Other configurations

For four-node SSP configurations, refer to the documentation that ships with the 4-Port Shared Storage Module.

For multipath software configurations, refer to the *HP Smart Array Multipath Software User Guide* that ships with that option.

For more information about these options, refer to the HP website (<http://www.hp.com/products/sharedstorage>).

Cabling the storage system

After installing the storage system in a rack, connect the SCSI cables and power cords to the rear panel.

SCSI cabling guidelines

Always be sure that the servers attached to the storage system are powered down and power cords are disconnected before connecting SCSI cables.

IMPORTANT: Before installing the Smart Array Multipath software on a server with a Microsoft® operating system, connect only one of the SCSI cables from each server to the MSA500 G2 storage system. Leave the second SCSI cable for the redundant path disconnected until after the multipath software is installed.

For SSP cabling configurations, refer to "SSP Hardware Configurations (on page [63](#))."

Cluster cabling guidelines

To cable the cluster:

1. Install the server cable management solution. Refer to the server documentation.
2. Connect the VHDCI SCSI cables to the storage system and servers.

For Microsoft® or Linux operating systems, connect the Ethernet crossover cable between the servers. Use the RJ-45 connectors identified as NIC 2 on each server.

3. Connect peripheral devices, such as a keyboard, mouse, or monitor.

IMPORTANT: HP recommends the use of a KVM switchbox. Refer to the documentation that ships with the switchbox.

Power cords

The power cord should be approved for use in your country. The power cord must be rated for the product and for the voltage and current marked on the electrical ratings label of the product. The voltage and current rating for the cord should be greater than the voltage and current rating marked on the product. In addition, the diameter of the wire must be a minimum of 1.00 mm² or 18 AWG, your maximum length may be up to 3.66 m (12 ft).



WARNING: To reduce the risk of electric shock or damage to the equipment:

- Do not disable the power cord grounding plug. The grounding plug is an important safety feature.
- Plug the power cord into a grounded (earthed) electrical outlet that is easily accessible at all times.
- Unplug the power cord from the power supply to disconnect power to the equipment.
- Do not route the power cord where it can be walked on or pinched by items placed against it. Pay particular attention to the plug, electrical outlet, and the point where the cord extends from the storage system.

To connect AC power cords:

1. Connect the power cords to the power supplies.
2. Connect the power cords to the AC power source.

Updating firmware

After installing hardware and powering up the storage system for the first time, be sure to verify that the storage system, controllers, HBAs, and drives have the latest firmware. For firmware and software updates, refer to the HP website (<http://www.hp.com/products/serverstorage>).

Hardware options installation

In this section

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| Firmware updates | 49 |
| Hot-plug SCSI hard drive options | 49 |
| 4-Port Shared Storage Module option | 51 |
| MSA500 G2 Controller option | 53 |
| Cache module upgrade option | 55 |
| MSA500 G2 high availability option | 58 |

Firmware updates

After installing hardware and powering up the storage system for the first time, be sure to verify that the storage system, controllers, HBAs, and drives have the latest firmware. For firmware and software updates, refer to the HP website (<http://www.hp.com/products/serverstorage>).

Hot-plug SCSI hard drive options

When adding SCSI hard drives to the storage system, observe the following general guidelines:

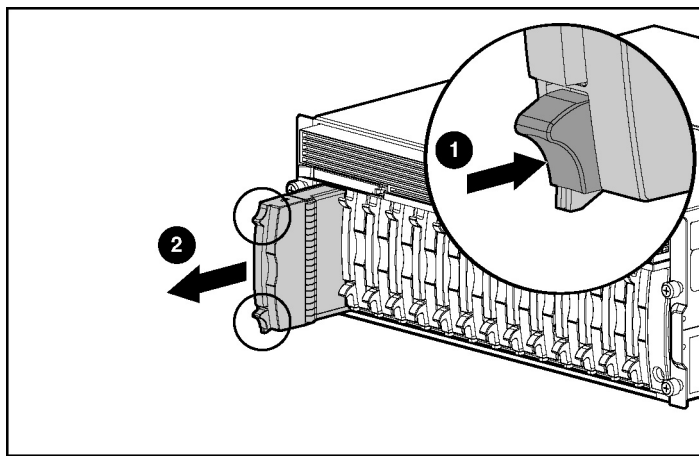
- The system automatically sets all SCSI IDs.
- If only one SCSI hard drive is used, install it in the bay with the lowest SCSI ID number. ("SCSI IDs" on page [22](#))
- Hot-plug hard drives must be 1-inch universal SCSI types.
- Drives must be the same capacity to provide the greatest storage space efficiency when drives are grouped together into the same drive array.

Removing hard drive blanks



CAUTION: To prevent improper cooling and thermal damage, do not operate the storage system unless all bays are populated with either a component or a blank.

To remove the component:

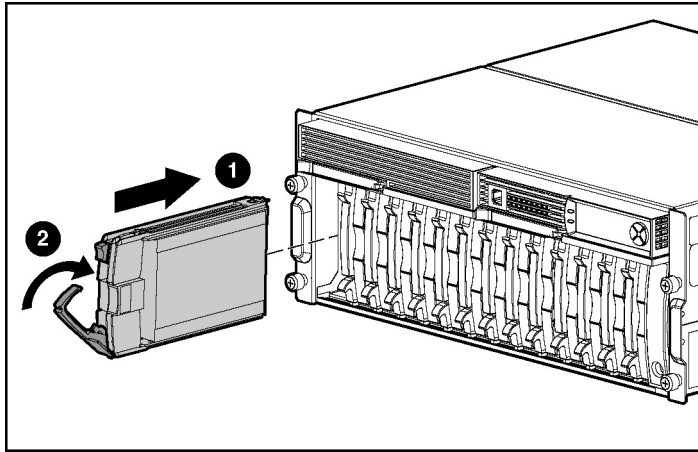


To replace the blank, slide the blank into the bay until it locks into place.

Installing hot-plug SCSI hard drives

1. Remove the existing hard drive blank or hard drive from the drive bay ("Removing hard drive blanks" on page [50](#)).

2. Install the hard drive.



3. Determine the status of the hard drive from the hot-plug hard drive LEDs ("Hot-plug SCSI hard drive LED combinations" on page 24, "Hot-plug SCSI hard drive LEDs" on page 23).

4-Port Shared Storage Module option

The storage system ships standard with a 2-Port Shared Storage Module. To upgrade the storage system and enable data transfer through four SCSI ports, install the optional 4-Port Shared Storage Module.

Module installation requirements

To ensure that the HBAs can negotiate I/O paths with the MSA500 G2 controllers, always install the most recent firmware for the 4-Port Shared Storage Module, the controller, and the HBAs:

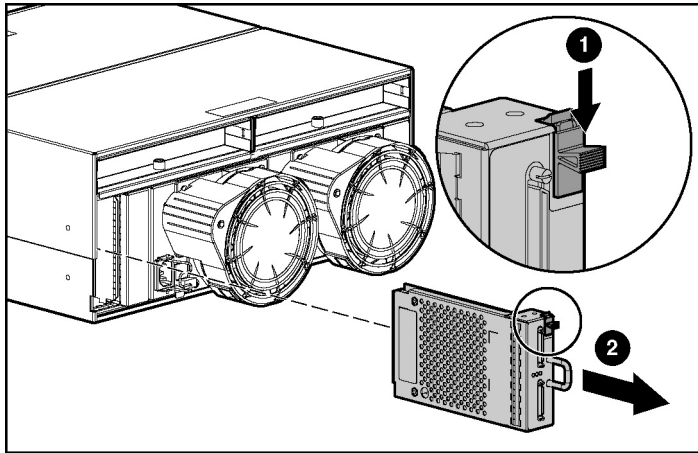
- For HBA firmware upgrade procedures, refer to the controller documentation that ships with the hardware.
- For controller and Shared Storage Module firmware upgrade procedures, refer to the HP website (<http://www.hp.com/support/proliantstorage>).

Installing the 4-port shared storage module

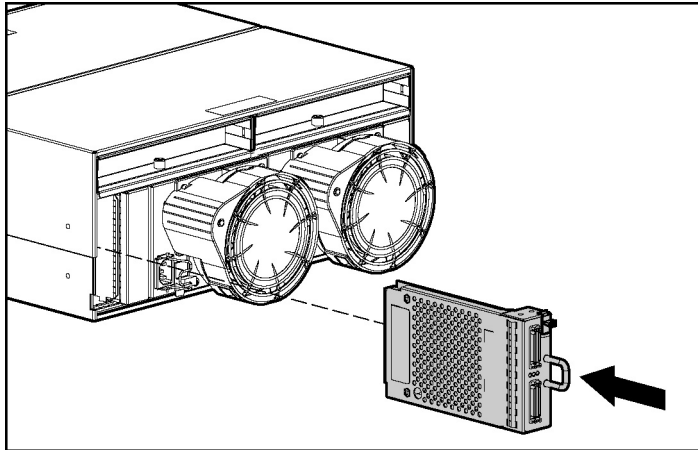


CAUTION: In systems that use external data storage, be sure that the server is the first unit to be powered down and the last to be powered back up. Taking this precaution ensures that the system does not erroneously mark the drives as failed when the server is powered up.

1. Power down the storage system (on page [28](#)).
2. Disconnect the SCSI cabling connected to the 2-Port Shared Storage Module.
3. Remove the 2-Port Shared Storage Module.



4. Install the 4-Port Shared Storage Module.



MSA500 G2 Controller option

The HP StorageWorks Modular Smart Array 500 Generation 2 storage system ships with one HP StorageWorks Modular Smart Array 500 Generation 2 controller. To provide redundancy and maximize uptime, install a second MSA500 G2 controller.

Controller installation requirements

Observe the following guidelines:

- If a controller has more than one cache DIMM, be sure that both DIMMs have the same memory capacity.
- Always upgrade the cache in both controllers in a storage system with redundant controllers.
- In a storage system with a redundant controller, be sure that both controllers have the same number of DIMMs and that all DIMMs have the same memory capacity.

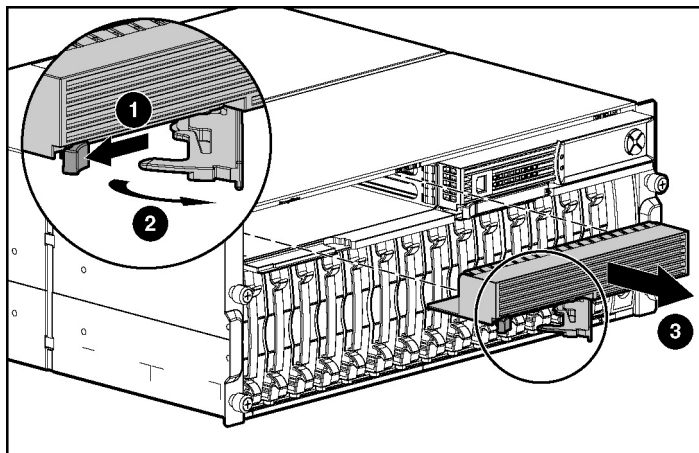
- To configure an MSA500 G2 storage system for controller redundancy, both controllers must execute the same version of firmware. If the controllers have different firmware versions, the storage system responds as follows:
 - In a hot-plug addition of the second controller, the storage system clones the firmware version of the active controller onto the second controller. After the second controller is reset, the controllers become redundant.
 - In a non-hot-plug addition of the second controller, the storage system examines the firmware versions of both controllers at power up and clones the most recent version from one controller to the other controller.

Installing the MSA500 G2 Controller



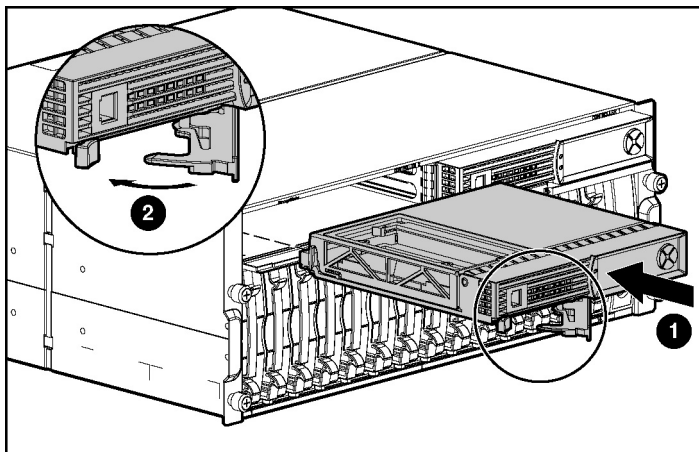
CAUTION: To prevent improper cooling and thermal damage, do not operate the storage system unless all bays are populated with either a component or a blank.

1. Remove the bezel blank.



2. Open the locking latch on the redundant controller.

3. Install the controller.



4. Verify that the component is seated properly by observing its LEDs when the storage system is at full power.

Cache module upgrade option

The MSA500 G2 controller ships with a 256-MB battery-backed cache module. A second 256-MB battery-backed cache module is available as an option.

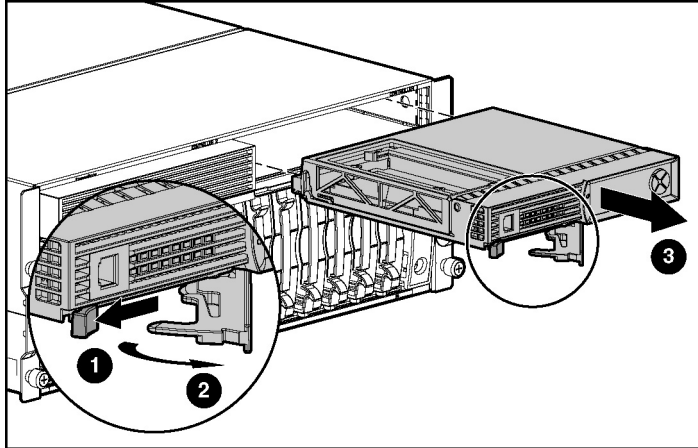
Cache module installation requirements

Observe the following guidelines:

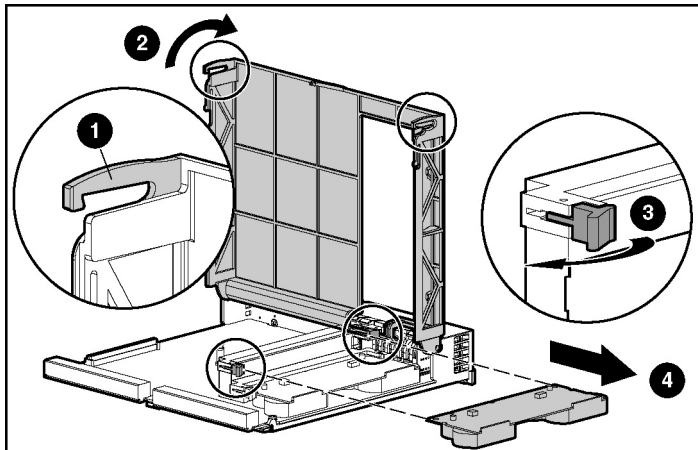
- Always power down the storage system when performing a cache upgrade.
- If a controller has more than one cache DIMM, be sure that both DIMMs have the same memory capacity.
- Always upgrade the cache in both controllers in a storage system with redundant controllers.
- In a storage system with a redundant controller, be sure that both controllers have the same number of DIMMs and that all DIMMs have the same memory capacity.

Installing the cache module upgrade

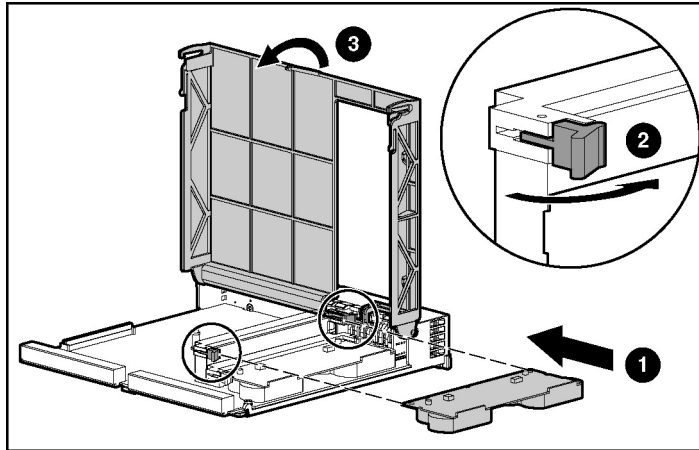
1. Power down the storage system (on page [28](#)).
2. Remove the controller.



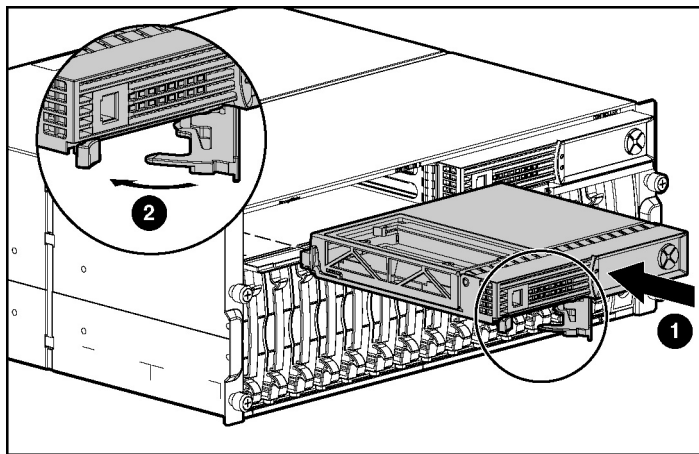
3. Remove the existing cache module.



4. Install the new cache module.



5. Install the controller.



6. Power up the storage system (on page [27](#)).
7. Verify that the component is seated properly by observing its LEDs when the storage system is at full power.

MSA500 G2 high availability option

The HP StorageWorks Modular Smart Array 500 Generation 2 storage system high availability kit transforms the standard shipping MSA500 G2 storage system into a redundant hardware solution that supports:

- Two-node clustering
- Array controller failover capability
- Up to four-node DAS with Ultra320 SCSI I/O

The kit contains the following hardware and software components:

- 4-Port Shared Storage Module
- HP Smart Array Multipath Software CD
- Two Smart Array 642 adapters
- An HP StorageWorks Modular Smart Array 500 Generation 2 controller
- Two 1.8-m (6-ft) VHDCI SCSI cables
- Assorted documentation

For instructions and further information about this option, refer to the HP website (<http://www.hp.com/products/sharedstorage>).

Configuration and utilities

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| Server utilities..... | 59 |
| ROM functions and utilities | 61 |
| Selective Storage Presentation..... | 63 |
| Array Configuration Utility | 64 |
| Array Diagnostic Utility | 67 |
| NetWare Online Array Configuration Utility (CPQONLIN) | 68 |

Server utilities

HP utilities provide reporting functions that enable event-focused management and diagnostics. To install and run these utilities, refer to the server documentation.

HP Insight Diagnostics

HP Insight Diagnostics is a proactive server management tool, available in both offline and online versions, that provides diagnostics and troubleshooting capabilities to assist IT administrators who verify server installations, troubleshoot problems, and perform repair validation.

HP Insight Diagnostics Offline Edition performs various in-depth system and component testing while the OS is not running. To run this utility, launch the SmartStart CD.

HP Insight Diagnostics Online Edition is a web-based application that captures system configuration and other related data needed for effective server management. Available in Microsoft® Windows® and Linux versions, the utility helps to ensure proper system operation.

For more information or to download the utility, refer to the HP website (<http://www.hp.com/servers/diags>).

HP Systems Insight Manager

HP SIM is a web-based application that allows system administrators to accomplish normal administrative tasks from any remote location, using a web browser. HP SIM provides device management capabilities that consolidate and integrate management data from HP and third-party devices.

IMPORTANT: You must install and use HP SIM to benefit from the Pre-Failure Warranty for processors, hard drives, and memory modules.

For additional information, refer to the Management CD in the HP ProLiant Essentials Foundation Pack or the HP SIM website (<http://www.hp.com/go/hpsim>).

Management Agents

Management Agents provide the information to enable fault, performance, and configuration management. The agents allow easy manageability of the server through HP SIM software, and third-party SNMP management platforms. Management Agents are installed with every SmartStart assisted installation or can be installed through the HP PSP. The Systems Management homepage provides status and direct access to in-depth subsystem information by accessing data reported through the Management Agents. For additional information, refer to the Management CD in the HP ProLiant Essentials Foundation Pack or the HP website (<http://www.hp.com/servers/manage>).

Survey Utility

Survey Utility, a feature within Insight Diagnostics, gathers critical hardware and software information on ProLiant servers.

This utility supports operating systems that may not be supported by the server. For operating systems supported by the server, refer to the HP website (<http://www.hp.com/go/supportos>).

If a significant change occurs between data-gathering intervals, the Survey Utility marks the previous information and overwrites the Survey text files to reflect the latest changes in the configuration.

Survey Utility is installed with every SmartStart-assisted installation or can be installed through the HP PSP.

ROM functions and utilities

Each MSA500 G2 controller has a ROM that contains the controller firmware.

Smart Components for ROM Flash

To update the firmware on the server, controller, or hard drives, use Smart Components. These components are available on the Firmware Maintenance CD. A more recent version of a particular server or controller component might be available on the support page of the HP website (<http://www.hp.com/support>). Components for controller and hard drive firmware updates are also available from the software and drivers page for storage products (<http://www.hp.com/support/proliantstorage>).

1. Find the most recent version of the component that you require. Components for controller firmware updates are available in offline and online formats.
2. Follow the instructions for installing the component on the server. These instructions are given with the CD and are provided on the same Web page as the component.

Follow the additional instructions that describe how to use the component to flash the ROM. These instructions are provided with each component.

Recovery ROM

The Recovery ROM feature stores two complete firmware images in the ROM: one active image and one backup image. When the controller is powering up, it checks both firmware images to be sure they are valid. If either image is invalid, the system overwrites the invalid image with the valid image.

This process, commonly called auto-flashing, is performed automatically by the controller and does not require any user intervention. The controller display provides messages for the status of this process.

Controller firmware auto cloning

In a redundant controller configuration, both controllers must execute the same version of firmware. During power up (or when a redundant controller is installed as a hot-plug procedure), the storage system compares the controller firmware versions. If the versions differ, the controller displays a user input message seeking to initiate Controller Firmware Auto Cloning.

If 60 seconds elapse with no user input, one of the following actions occurs:

- In a non-hot-plug environment, the controller with the most recent firmware disables the controller with the older firmware and continues the power-up sequence. This method prevents automatic loss of a previous version of firmware.
- In a hot-plug environment, cloning begins automatically, and the storage system overwrites one firmware version with the other version.

When the cloning is complete, the storage system resets the modified controller. After the modified controller powers up, the controllers begin operating in redundant mode.

The storage system clones firmware based on the following criteria:

- **Non-Hot-Plug Cloning**—If the storage system powers up with both controllers installed, the storage system clones the most recent firmware version from either controller.
- **Hot-Plug Cloning**—If the storage system is operating and an optional redundant controller is installed, the storage system clones the firmware version from the primary controller, regardless of which firmware version is more recent. This cloning method ensures that all host-initiated I/O remains uninterrupted during storage system operation.
- **Incompatible Version Cloning**—If a specific version of firmware is incompatible with certain hardware revisions of a controller, the storage system displays the user input message seeking to initiate Controller Firmware Auto Cloning and clones the most recent firmware version that is compatible with both controllers.

IMPORTANT: During incompatible version cloning, the storage system does not reset the updated controller if the controller is operating and processing I/O. In this case, the storage system does not enter redundant mode and provides an informational message on the controller display. To configure redundancy, cycle the storage system power.

Selective Storage Presentation

SSP is a controller firmware feature that enables the administrator to control access from hosts to logical drives on the MSA500 G2 storage system. The administrator selects which server host or hosts can access the stored data, restricting access as needed to assure data integrity and security.

Each logical drive on the HP StorageWorks Modular Smart Array 500 Generation 2 controller has an access control list that contains the IDs of the server host adapters that have access to the drive. If a server attempts to send commands to a logical drive without access authority, the controller rejects the command.

The configuration utility maps the IDs of server host adapters to connection names and sets up access control lists for logical drives based on the adapter IDs.

SSP hardware configurations

To configure the hardware for SSP, use SCSI cables to connect each server to the 2-Port or 4-Port Shared Storage Module installed in the storage system. Boot volumes for individual servers can reside on server drives or storage system drives.

Enabling SSP

After choosing the configuration that best suits your needs, enable SSP with ACU Version 7.10 or later. Locate ACU on the SmartStart CD. For instructions, refer to the *HP Array Configuration Utility User Guide* on the Documentation CD.

Array Configuration Utility

ACU is a browser-based utility with the following features:

- Runs as a local application or remote service
- Supports online array capacity expansion, logical drive extension, assignment of online spares, and RAID or stripe size migration
- Suggests the optimum configuration for an unconfigured system
- Provides different operating modes, enabling faster configuration or greater control over the configuration options
- Remains available any time that the server is on
- Displays on-screen tips for individual steps of a configuration procedure

For optimum performance, the minimum display settings are 800 × 600 resolution and 256 colors. Servers running Microsoft® operating systems require Internet Explorer 5.5 (with Service Pack 1) or later. For Linux servers, refer to the README.TXT file for additional browser and support information.

For more information, refer to the *HP Array Configuration Utility User Guide* on the Documentation CD or the HP website (<http://www.hp.com>).

Moving drives and arrays

You can move drives to other ID positions on the same array controller. You can also move a complete array from one controller to another, even if the controllers are on different storage systems.

Before you move drives, the following conditions must be met:

- The move will not result in more than 14 physical drives per controller channel.
- No controller will be configured with more than 32 logical volumes.
- The array has no failed or missing drives.
- The array is in its original configuration.

- The controller is not reading from or writing to any of the spare drives in the array.
- The controller is not running capacity expansion, capacity extension, or RAID or stripe size migration.
- The controller is using the latest firmware version (recommended).

If you want to move an array to another controller, you must also consider the following additional limitations:

- All drives in the array must be moved at the same time.
- Drive positions of the destination controller must match original drive positions.

When all the conditions have been met:

1. Back up all data before removing any drives or changing configuration. This step is **required** if you are moving data-containing drives from a controller that does not have a battery-backed cache.
2. Power down the storage system (on page [28](#)).
3. If you are moving an array from a controller that contains a RAID ADG logical volume to a controller that does not support RAID ADG:
 - a. Remove or disconnect the drives that contain the RAID ADG logical volume.
 - b. Reboot the storage system.
 - c. Open ACU and navigate to the controller that contained the RAID ADG volume.

ACU displays the missing RAID ADG volume using a different icon to indicate that the volume is unavailable.
 - d. Delete the RAID ADG volume.
 - e. Accept the configuration change, and then close ACU.
 - f. Power down the storage system (on page [28](#)).
4. Move the drives.
5. Power up the storage system (on page [27](#)).

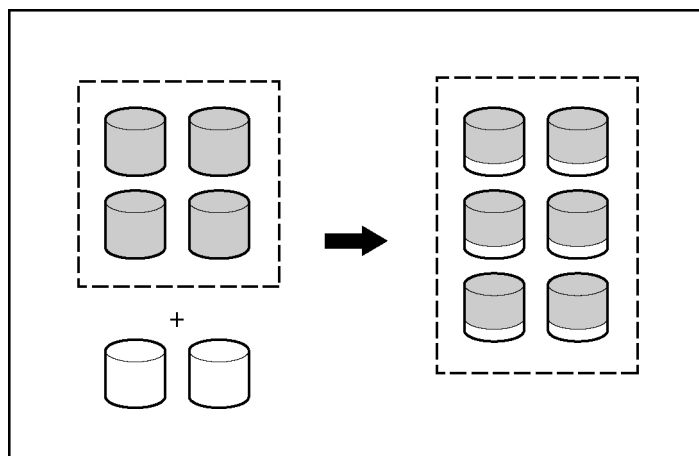
- If an 86 controller display message appears, drive positions were changed successfully and the configuration was updated.
 - If a 121 controller display (no volumes) message appears, power down the system immediately to avoid data loss, and return the drives to their original positions.
6. Check the new drive configuration by running ORCA or ACU.

Expanding and extending capacity

You can add hard drives to a system at any time, as long as you do not exceed the maximum number of drives that the controller supports. You can then either build a new array from the added drives or use the extra storage capacity to expand the capacity of an existing array.

To perform an array capacity expansion, use ACU. If the system is using hot-pluggable drives, you can expand array capacity without shutting down the operating system (that is, with the server online) if ACU is running in the same environment as the normal server applications. (For more information, refer to the *HP Array Configuration Utility User Guide*.)

The expansion process is illustrated in the following figure, in which the original array (containing data) is shown with a dashed border and the newly added drives (containing no data) are shown unshaded. The array controller adds the new drives to the array and redistributes the original logical drives over the enlarged array one logical drive at a time. This process liberates some storage capacity on each of the physical drives in the array. During this procedure, the logical drives each keep the same fault-tolerance method in the enlarged array that they had in the smaller array.



When the expansion process has finished, you can use the liberated storage capacity on the enlarged array to create new logical drives. Alternatively, you can enlarge one of the original logical drives. This latter process is called **logical drive capacity extension** and is also carried out using ACU.

Array Diagnostic Utility

ADU is tool that collects information about array controllers and generates a list of detected problems. ADU can be accessed from the SmartStart CD or downloaded from the HP website (<http://www.hp.com>).

NetWare Online Array Configuration Utility (CPQONLIN)

The NetWare Online Array Configuration Utility, also called CPQONLIN, is an NLM for configuring drive arrays without shutting down the storage system. CPQONLIN also provides information about the status of drives attached to the MSA500 G2 controller. It indicates drive failure, expansion, or waiting for expansion or rebuild (queued). Before loading *CPQONLIN.NLM*, you must load the appropriate device drivers: *CPQRAID.HAM* and *CPQSHD.CDM*.

CPQONLIN.NLM is located in the ProLiant Support Pack found on the SmartStart CD and it is available on the support software CD that ships with the storage system.

IMPORTANT: CPQONLIN supports SSP configurations; however, you can also use ACU 7.10 (or later) offline to enable SSP configurations in a NetWare environment.

Using auto-configuration

If no logical drives are configured, a CPQONLIN auto-configuration wizard appears and prompts you to select fault-tolerance information. CPQONLIN then configures arrays optimally for the selected fault tolerance.

Creating a custom configuration

Custom configuration enables you to create arrays and assign fault tolerance one array at a time. To custom configure an array:

1. Go to the Main Configuration View screen.
2. Highlight the controller, array, or logical drives to be configured.
3. Make a selection from the Options menu located on the right side of the screen.
4. Use online help for completing configurations. The following sections discuss CPQONLIN functions.

Customizing the chassis name

The Chassis Name field is available for a user-defined, customized name that helps define the connection between the server HBA and the storage system controller. This field prevents the user from relying entirely on the adapter ID of the host controller for identification purposes.

Enabling chassis identification

The Identify Chassis field enables the user to set the Chassis Blink Status. When enabled through the server HBA, CPQONLIN directs the storage system controller to start flashing the hard drives LEDs in the storage system chassis. When the setting is disabled, the hard drive LEDs stop flashing.

Setting drive rebuild, expand priority, and accelerator ratio

1. Go to the Main Configuration View screen.
2. Highlight the controller.
3. Select the **Controller Settings** option below Controller Options. The Controller Settings screen appears.

Drive rebuild

Drive rebuild occurs after a physical drive fails and is replaced. Only logical drives configured for fault tolerance (RAID 1, RAID 5, ADG) on the array with the failed physical drive will rebuild.

Priority settings

To set the drive rebuild priority:

1. Highlight the MSA500 G2 controller.
2. Select the controller settings:
 - If you choose low priority for drive rebuild, drive rebuilding occurs when I/O to the drive is inactive.
 - If you choose high priority, drive rebuilding occurs faster, at the expense of normal I/O operations.

Accelerator ratio

The MSA500 G2 controller has an onboard cache called an Array Accelerator, which performs both write-posting and read-ahead caching. The setting in CPQONLIN determines the amount of memory allocated to the read and write caches.

For example, if the Accelerator Ratio is set to Read 75%:Write 25%, 75% of Array Accelerator cache is dedicated to read-ahead cache and 25% is dedicated to the write-posting cache. This option can be modified from the Controller Settings menu.

Expanding an array

During an expand, performance may be slightly degraded. In most cases, however, any potential degradation is offset by the addition of physical drives. Some tips for expanding include:

- Perform the expand process during periods of low server use. If you must expand during peak periods, CPQONLIN enables you to set the priority of the expand. Setting the priority to LOW affects performance the least, but it takes longer for the new space to become available.
- When expanding, always add drives with a capacity equal to or greater than the capacity of the smallest drive in the array. Adding larger drives wastes space because only the space that is equal to the smallest drive size can be used.

Adding or configuring spare drives

When adding a spare drive to an array, an unassigned drive must exist or a drive already assigned as a spare must exist on another array. You can assign a single spare to any number of arrays or assign separate spares.

When you select **Assign Spare Drive**, only drives that qualify appear (for example, only those spares that are large enough appear). If drives that you expect to see do not appear, switch to the physical drive view (**Tab** key), and check the size of the drives. The capacity of the spare must be equal to or greater than the capacity of the smallest drive in the array.

Migrating RAID level and stripe size online

Using CPQONLIN, you can modify both the RAID level and stripe size of an existing logical drive while online. To migrate a drive:

1. Select the drive setting option under the logical drive menu for the drive you intend to modify.
2. Select the new RAID level and/or stripe size from the choices presented. If the new settings are valid, the migration begins when you save the changes.

Cluster installation and configuration

In this section

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Cluster hardware installation

To install the cluster:

1. Select an installation site that meets the optimum environment requirements. Refer to the server documentation.
2. Install the storage system into the rack.
3. Install the servers into the rack, directly above the storage system. Refer to the server documentation.
4. Install options:
 - To install storage system options, refer to "Hardware Options Installation (on page [49](#))."
 - To install server options, refer to the server documentation or the documentation that ships with the option.
5. Cable the system:
 - a. Install the server cable management solution. Refer to the server documentation.
 - b. Connect the VHDCI SCSI cables to the storage system and servers.
For Microsoft® or Linux operating systems, connect the Ethernet crossover cable between the servers. Use the RJ-45 connectors identified as NIC 2 on each server.
 - c. Connect peripheral devices, such as a keyboard, mouse, or monitor.

IMPORTANT: HP recommends the use of a KVM switchbox. Refer to the documentation that ships with the switchbox.

6. Connect the power cords.

IMPORTANT: HP recommends the use of a UPS. Contact the nearest authorized reseller.

Cluster configuration

Depending on the operating system, use the appropriate installation instructions provided on the HP website (<http://www.hp.com/servers/proliant/highavailability>).

The ProLiant high availability website has a link to technical white papers that cover a variety of topics for each ProLiant cluster product. Topics include:

- Installation checklists
- Best practices
- Deployment
- Migration checklists
- Applications
- General cluster information

Troubleshooting

In this section

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| Recognizing hard drive failure | 78 |
| Factors to consider before replacing hard drives | 81 |
| Automatic data recovery (rebuild)..... | 82 |
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When the storage system does not start

If the storage system does not start:

1. Be sure that the attached server and monitor are working properly.
2. Be sure that the storage system is plugged into working outlets.
3. Be sure that the power source is working properly:
 - Check the status using the system power LED on the front panel.
 - Be sure that the Power On/Standby button was pressed firmly.
4. Be sure that the power supplies are working properly:

Check the status using the power supply LEDs ("Power supply/blower assembly LEDs" on page [14](#)).

5. Restart the system.

IMPORTANT: If the system does not restart, proceed to "Diagnostic Steps (on page [76](#))."

6. Check the storage system for the following normal power-up sequence to be sure that the system meets the minimal hardware requirements and is powered up during normal operations:
 - a. The front panel power LED turns from off (standby/off) to on (solid green).

- b. The blowers start up.
 - c. The 2-Port or 4-Port Shared Storage Module LED flashes green.
7. The controller display provides a `Startup Complete` message.

Diagnostic steps

If the storage system does not power up or powers up but does not complete POST, answer the questions in the following table to determine appropriate actions based on the symptoms observed.

According to the answers you give, you are directed to the appropriate table. That table outlines possible reasons for the problem, options available to assist in diagnosis, possible solutions, and references to other sources of information.

| Question | Action |
|--|---|
| Question 1: Are the power supply/blower assembly LEDs green? | If yes, continue to question 2. If no, refer to "Are the Power Supply/Blower Assembly LEDs green? (on page 77)." |
| Question 2: Is the system power LED green? | If yes, continue to question 3. If no, refer to "Is the System Power LED Green? (on page 77)." |
| Question 3: Is the controller display providing messages? | If yes, use the messages for further diagnosis. If no, refer to "Is the Controller Display Providing Messages? (on page 78)." |

Are the power supply/blower assembly LEDs green?

| Answer | Possible Reasons | Possible Solutions |
|--------|---|---|
| No | <p>The power cords are not connected or AC power is not available.</p> <p>The power supply may not be inserted properly, it may have a damaged connector, or it may have failed.</p> <p>The system backplane may need to be replaced.</p> | <p>Be sure that the power cord is connected to the power supply.</p> <p>Be sure that the power supply is undamaged and is fully seated.</p> <p>Be sure that all pins on connectors and components are straight.</p> <p>Contact an authorized service provider for assistance.</p> |
| Yes | — | <p>If the system power LED is off, do the following:</p> <ol style="list-style-type: none"> 1. Press the Power On/Standby button. 2. Refer to Is the System Power LED Green? (on page 77). |

Is the system power LED green?

| Answer | Possible Reasons | Possible Solutions |
|--------|--|--|
| No | <p>The Power On/Standby button has not been pressed firmly.</p> <p>The power supply may not be inserted properly, it may have a damaged connector, or it may have failed.</p> <p>The system may have experienced a short.</p> <p>Controller firmware may be corrupted.</p> <p>The system backplane and/or power button/LED assembly may need to be replaced.</p> | <p>Firmly press the Power On/Standby button.</p> <p>Be sure that the power supply is undamaged and is fully seated.</p> <p>Be sure that all pins on connectors and components are straight.</p> <p>Be sure that all components are fully seated.</p> <p>Flash the controller firmware ("Smart Components for ROM Flash" on page 61).</p> <p>Contact an authorized service provider for assistance.</p> |
| Yes | — | <p>If the system power LED is green, refer to "Is the Controller Display Providing Messages?" (on page 78)."</p> |

Is the controller display providing messages?

| Answer | Possible Reasons | Possible Solutions |
|--------|--|---|
| No | The controller may not be inserted properly, it may have a damaged connector, or it may have failed. | <p>Be sure that the controller is undamaged and is fully seated.</p> <p>Be sure that all pins on connectors and components are straight.</p> <p>Contact an authorized service provider for assistance.</p> <p>When the controller display is working properly, refer to the Yes response below.</p> |
| Yes | — | Display messages are available for diagnosis. Determine the next action by observing the messages ("Display messages" on page 85). |

Recognizing hard drive failure

In an HP storage system, a steadily glowing Fault LED indicates that that drive has failed. When a drive is configured as part of an array and attached to a powered up controller, the status of the drive can be determined from the illumination pattern of the controller LEDs (on page [20](#)).

Other means by which hard drive failure is revealed are:

- The amber LED on the front of a storage system illuminates if failed drives are inside. (However, this LED also illuminates when other problems occur, such as when a blower fails, a redundant power supply fails, or the system overheats.)
- A controller display message lists failed drives whenever the system is restarted, as long as the controller detects at least one functional drive.
- ACU represents failed drives with a distinctive icon.
- HP SIM can detect failed drives remotely across a network. (For more information about HP SIM, refer to the documentation on the Management CD.)

- ADU lists all failed drives.
- CPQONLIN identifies failed drives in a NetWare environment.

For additional information about diagnosing hard drive problems, refer to the *HP ProLiant Servers Troubleshooting Guide*.



CAUTION: Sometimes, a drive that has previously been failed by the controller may seem to be operational after the system is power-cycled or (for a hot-pluggable drive) after the drive has been removed and reinserted. However, continued use of such marginal drives may eventually result in data loss. Replace the marginal drive as soon as possible.

Effects of a hard drive failure

When a hard drive fails, all logical drives that are in the same array are affected. Each logical drive in an array may be using a different fault-tolerance method, so each logical drive can be affected differently.

- RAID 0 configurations cannot tolerate drive failure. If any physical drive in the array fails, all non-fault-tolerant (RAID 0) logical drives in the same array will also fail.
- RAID 1+0 configurations can tolerate multiple drive failures as long as no failed drives are mirrored to one another.
- RAID 5 configurations can tolerate one drive failure.
- RAID ADG configurations can tolerate simultaneous failure of two drives.

Compromised fault tolerance

If more hard drives fail than the fault-tolerance method allows, fault tolerance is compromised, and the logical drive fails. In this case, all requests from the operating system are rejected with unrecoverable errors. You are likely to lose data, although it can sometimes be recovered.

One example of a situation in which compromised fault tolerance may occur is when a drive in an array fails while another drive in the array is being rebuilt. If the array has no online spare, any logical drives in this array that are configured with RAID 5 fault tolerance will fail.

Compromised fault tolerance can also be caused by non-drive problems, such as a faulty cable or temporary power loss to a storage system. In such cases, you do not need to replace the physical drives. However, you may still have lost data, especially if the system was busy at the time that the problem occurred.

Recovering from compromised fault tolerance

If fault tolerance is compromised, inserting replacement drives does not improve the condition of the logical volume. Instead, if the screen displays unrecoverable error messages, perform the following procedure to recover data:

1. Check for loose, dirty, broken, or bent cabling and connectors on all devices.
2. Power down the storage system (on page [28](#)).
3. Power up the storage system (on page [27](#)).

In some cases, a marginal drive will work again for long enough to enable you to make copies of important files.

4. If an 02 or 04 controller display message is displayed, press the **Right** button to re-enable the logical volumes. Remember that data loss has probably occurred and any data on the logical volume is suspect.
5. Make copies of important data, if possible.
6. Replace any failed drives.
7. After you have replaced the failed drives, fault tolerance may again be compromised. If so, cycle the power again, and if the 02 or 04 controller display message is displayed, press the **Right** button to re-enable the logical volumes.

Factors to consider before replacing hard drives

- In systems that use external data storage, be sure that the server is the first unit to be powered down and the last to be powered back up. Taking this precaution ensures that the system does not erroneously mark the drives as failed when the server is powered up.
- If you set the SCSI ID jumpers manually:
 - Check the ID value of the removed drive to be sure that it corresponds to the ID of the drive marked as failed.
 - Set the same ID value on the replacement drive to prevent SCSI ID conflicts.

Before replacing a degraded drive:

- Open HP SIM and inspect the Error Counter window for each physical drive in the same array to confirm that no other drives have any errors. (For details, refer to the HP SIM documentation on the Management CD.)
- Be sure that the array has a current, valid backup.
- Use replacement drives that have a capacity at least as great as that of the smallest drive in the array. The controller immediately fails drives that have insufficient capacity.

To minimize the likelihood of fatal system errors, take these precautions when removing failed drives:

- Do not remove a degraded drive if any other drive in the array is offline (the Online LED is off). In this situation, no other drive in the array can be removed without data loss.

Exceptions:

- When RAID 1+0 is used, drives are mirrored in pairs. Several drives can be in a failed condition simultaneously (and they can all be replaced simultaneously) without data loss, as long as no two failed drives belong to the same mirrored pair.
- When RAID ADG is used, two drives can fail simultaneously (and be replaced simultaneously) without data loss.
- If the offline drive is a spare, the degraded drive can be replaced.

- Do not remove a second drive from an array until the first failed or missing drive has been replaced **and** the rebuild process is complete. (The rebuild is complete when the Online LED on the front of the drive stops blinking.)

These cases are the exceptions:

- In RAID ADG configurations, any two drives in the array can be replaced simultaneously.
- In RAID 1+0 configurations, any drives that are not mirrored to other removed or failed drives can be simultaneously replaced offline without data loss.

Automatic data recovery (rebuild)

When you replace a hard drive in an array, the controller uses the fault-tolerance information on the remaining drives in the array to reconstruct the missing data (the data that was originally on the replaced drive) and write it to the replacement drive. This process is called automatic data recovery, or rebuild. If fault tolerance is compromised, this data cannot be reconstructed and is likely to be permanently lost.

If another drive in the array fails while fault tolerance is unavailable during rebuild, a fatal system error may occur, and all data on the array is then lost. In exceptional cases, however, failure of another drive need not lead to a fatal system error. These exceptions include:

- Failure after activation of a spare drive
- Failure of a drive that is not mirrored to any other failed drives (in a RAID 1+0 configuration)
- Failure of a second drive in a RAID ADG configuration

Time required for a rebuild

The time required for a rebuild varies considerably, depending on several factors:

- The priority that the rebuild is given over normal I/O operations (you can change the priority setting by using ACU)
- The amount of I/O activity during the rebuild operation

- The rotational speed of the hard drives
- The availability of drive cache
- The brand, model, and age of the drives
- The amount of unused capacity on the drives
- The number of drives in the array (for RAID 5 and RAID ADG)

Allow approximately 15 minutes per gigabyte for the rebuild process to be completed. This figure is conservative, and newer drive models usually require less time to rebuild.

System performance is affected during the rebuild, and the system is unprotected against further drive failure until the rebuild has finished. Therefore, replace drives during periods of low activity when possible.



CAUTION: If the Online LED of the replacement drive stops blinking and the amber Fault LED glows, or if other drive LEDs in the array go out, the replacement drive has failed and is producing unrecoverable disk errors. Remove and replace the failed replacement drive.

When automatic data recovery has finished, the Online LED of the replacement drive stops blinking and begins to glow steadily.

Failure of another drive during rebuild

If a non-correctable read error occurs on another physical drive in the array during the rebuild process, the Online LED of the replacement drive stops blinking and the rebuild abnormally terminates.

If this situation occurs, reboot the server. The system may temporarily become operational long enough to allow recovery of unsaved data. In any case, locate the faulty drive, replace it, and restore data from backup.

Drive failure in a NetWare environment

Use CPQONLIN to identify and monitor drive failure status in a NetWare environment.

Failed drives or interim recovery mode

If a drive fails and hardware fault tolerance is enabled, operation continues. Do the following:

1. Replace the drive as soon as possible.
2. Select a logical drive.
3. Press the **F3** key to monitor to the status of drive recovery.

Drive status messages include:

- **Interim Recovery:** The logical drive is operating, but a failed drive has not been replaced. Replace the drive as soon as possible.
- **Ready for Recovery:** The logical drives are queued for recovery. This status is displayed when another logical drive is already rebuilding or expanding.
- **Rebuilding:** The array is operating and rebuilding a replacement drive or an online spare, if one was assigned.
- **Logical Drive Failed:** If you have one or more logical drives that are not protected by fault tolerance in an array, the data on these logical drives will be lost. ACU shows the logical drives as FAILED. After drive replacement, any fault-tolerant logical drives rebuild. The logical drives that were not protected (FAILED) become available for data (the devices are reactivated automatically). If you have a backup of the data, restore the data now.

If you do not replace the failed drive, the only option, using ACU, is to delete logical drives. Do **not** delete logical drives that contain valid data. Doing so results in data loss.

NOTE: A failed status can occur on drives protected by fault tolerance if two or more physical drives fail concurrently.

Some status messages are available without pressing the **F3** key. For example, on the Main menu, the FAILED status appears next to the logical drive that has failed. EXPANDING and REBUILDING appear next to the array in which the activity is occurring.

Handling disk drive failures

If the MSA500 G2 controller was configured with hardware fault tolerance, complete the following steps after a disk drive failure:

- 1. Determine which physical drive failed. On hot-plug drives, an amber drive failure LED illuminates.
- 2. If the unit containing the failed drive does not support hot-plug drives, perform a normal shutdown.
- 3. Remove the failed drive and replace it with a drive that is of the same capacity. For hot-plug drives, after you secure the drive in the bay, the LEDs on the drive each flash once in an alternating pattern to indicate a successful connection. The online LED flashes, indicating that the controller recognized the drive replacement and began the recovery process.
- 4. Power up the server, if applicable.
- 5. The MSA500 G2 controller reconstructs the information on the new drive, based on information from the remaining physical drives in the logical drive. While reconstructing the data on hot-plug drives, the online LED flashes. When the drive rebuild is complete, the online LED is illuminated.

NetWare cannot detect a single physical drive failure when using hardware-based fault tolerance; NetWare determines that the data is still valid and accessible during the rebuilding process. However, the driver knows that a physical drive has failed. A message is printed on the console notifying the user that a physical drive is in a degraded state. CPQONLIN also shows that the drive has failed.

Display messages

List of messages:

Box numbering [88](#)
00 Array Controller Firmware Ver <version> [89](#)

| | |
|---|---------------------|
| 01 HP MSA500-G2 Startup Complete | 89 |
| 02 Enable Volume <n>? '<'=NO, '>'=YES | 89 |
| 03 Critical Lock-Up Detected. Code=<n>h | 89 |
| 04 Enable Volumes ? '<'=NO, '>'=YES | 90 |
| 05 System Name: <name>..... | 90 |
| 06 Restarting System | 91 |
| 07 Clone Firmware? '<'=NO, '>'=YES | 91 |
| 08 Firmware Flash Failed | 91 |
| 20 Initializing SCSI Subsystem | 92 |
| 21 Scanning for SCSI Devices | 92 |
| 22 Initializing SCSI Devices | 92 |
| 24 Bad SCSI Bus Mode Non-LVD Device Found..... | 92 |
| 30 I2C Read Failure <I2C device name> | 93 |
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Box numbering

The display message may specify a box number. Box 1 is the MSA500 G2 storage system.

00 Array Controller Firmware Ver <version>

Type: Informational

Description: Displays the current version of the firmware running on the controller.

Action: None

01 HP MSA500-G2 Startup Complete

Type: Informational

Description: The controller completed its power up sequence and is now operational.

Action: None

02 Enable Volume <n>? '<'=NO, '>'=YES

Type: User Input

Description: An issue exists with a configured volume that may result in data loss. Refer to display messages for more information.

Action:

- Selecting **NO** or not selecting any option within the timeout period causes the controller to disable the volume, so the user can attempt to fix the issue.
- Selecting **YES** causes the controller to enable the volume regardless of the issue.

03 Critical Lock-Up Detected. Code=<n>h

Type: Error

Description: The controller firmware detected a critical error. To prevent any possible data loss, the firmware has entered a lock-up state. The code contains engineering-specific information about the lock-up condition. Contact HP support.

Action:

1. Remove the failing controller.
2. Wait 10 seconds.
3. Reinstall the controller, and be sure that it seats fully in the chassis.

If this action does not solve the problem, contact HP support.

04 Enable Volumes ? '<'=NO, '>'=YES

Type: User Input

Description: An issue exists with all configured volumes that may result in data loss.

Action: Refer to display messages for more information.

05 System Name: <name>

Type: Informational

Description: Displays the user assigned name for the MSA500 G2 storage system. This name can be assigned using ACU.

Action: None

06 Restarting System

Type: Informational

Description: Indicates that the system has been reset and is being restarted.

Action: None

07 Clone Firmware? '<'=NO, '>'=YES

Type: User Input

Description: The controller is attempting to enter redundant mode but needs to clone the firmware. The controller is requesting confirmation from the user to overwrite the current firmware with the version from the redundant controller.

Action:

- If the user selects **YES**, the firmware is cloned.
- If the user selects **NO**, the firmware disables the controller.
- If the user does not respond within 60 seconds, the controller does the following:
 - In a non-hot-plug environment, the controller with the most recent firmware disables the controller with the older firmware and continues the power-up sequence. This method prevents automatic loss of a previous version of firmware.
 - In a hot-plug environment, cloning begins automatically, and the storage system overwrites one firmware version with the other version.

08 Firmware Flash Failed

Type: Error

Description: The active controller was unable to clone the firmware onto a redundant controller after two consecutive attempts.

Action: Remove the failed controller.

20 Initializing SCSI Subsystem

Type: Informational

Description: The SCSI subsystem is being initialized as part of the power up sequence.

Action: None

21 Scanning for SCSI Devices

Type: Informational

Description: The controller is scanning for hard drives.

Action: None

22 Initializing SCSI Devices

Type: Informational

Description: The controller is initializing the hard drives.

Action: None

24 Bad SCSI Bus Mode Non-LVD Device Found

Type: Error

Description: The MSA500 G2 storage system does not support SCSI SE devices; it only supports SCSI LVD devices.

Action:

1. Power down the storage system (on page [28](#)).

2. Examine all attached SCSI devices.
3. Remove any SE devices found and replace them with LVD devices.

30 I2C Read Failure <I2C device name>

Type: Error

Description: Read access has failed on an internal device on an I2C hardware bus. Certain I2C devices are considered critical and result in a failure of the controller while others may result in some loss of functionality (such as lost display messages).

Action: Replace the device. If this action does not solve the problem, contact HP support.

31 I2C Write Failure <I2C device name>

Type: Error

Description: Write access has failed on an internal device on an I2C hardware bus. Certain I2C devices are considered critical and result in a failure of the controller while others may result in some loss of functionality (such as lost display messages).

Action: Replace the device. If this action does not solve the problem, contact HP support.

32 Chassis NVRAM Contents Corrupted

Type: Error

Description: NVRAM is corrupt. The storage system cannot continue to operate.

Action: Contact HP support.

40 Begin Redundancy Support

Type: Informational

Description: The controllers are attempting to enter redundant mode.

Action: None

41 Redundancy Active Active Controller

Type: Informational

Description: The controllers are now in redundant mode and this controller is **active** with enabled access to the configured volumes on the MSA500 G2 storage system.

Action: None

42 Redundancy Active Standby Controller

Type: Informational

Description: The controllers are now in redundant mode and this controller is in **standby**, available to be made **active** if the current active controller fails assuming proper cabling and installation.

Action: None

43 Redundancy Failed Hardware Failure

Type: Error

Description: While either attempting to enter redundant mode or already operating in redundant mode, one of the controllers encountered a hardware failure on the communication channel between the two controllers. Redundancy is disabled at this time.

Action:

If the storage system is currently involved in host I/O:

1. Remove the standby controller.
2. Wait 10 seconds.
3. Reinstall the controller, and be sure that it seats fully in the chassis.

If this action does not solve the problem, wait until downtime is available and do the following:

1. Power down the storage system (on page [28](#)).
2. Remove both controllers.
3. Reinstall both controllers, and be sure that they seat fully in the chassis.

If this action does not solve the problem, contact HP support.

44 Redundancy Failed Mismatch Hardware

Type: Error

Description: Both controllers must contain the same hardware for them to successfully enter redundant mode. The current controllers do not contain the same hardware, possibly because one has an attached fibre daughter card and the other does not or because one of the controllers is from a previous generation of the storage system.

Action:

If the storage system is currently involved in host I/O:

1. Remove the standby controller.
2. Add or replace the fibre daughter card, as needed.
3. Wait 10 seconds.
4. Reinstall the controller, and be sure that it seats fully in the chassis.

If this action does not solve the problem, wait until downtime is available and do the following:

1. Power down the storage system (on page [28](#)).
2. Remove both controllers.
3. Add or remove fibre daughter cards, as needed, on both controllers.
4. Reinstall both controllers, and be sure that they seat fully in the chassis.

If this action does not solve the problem, contact HP support.

45 Redundancy Failed Mismatch Hardware

Type: Error

Description: Controller Firmware Auto Cloning has failed. Both controllers must be running the same version of firmware for redundant mode.

Action: Manually update the firmware on the older controller.

47 Redundancy Failed Cache Size Mismatch

Type: Error

Description: Both controllers must have the same size of cache memory for redundant mode.

Action:

If the storage system is currently involved in host I/O:

1. Remove the standby controller.
2. Add or remove cache memory, as needed.
3. Wait 10 seconds.
4. Reinstall the controller, and be sure that it seats fully in the chassis.

If this action does not solve the problem, wait until downtime is available and do the following:

1. Power down the storage system (on page [28](#)).
2. Remove both controllers.
3. Add or remove cache memory, as needed, on both controllers.
4. Reinstall both controllers, and be sure that they seat fully in the chassis.

If this action does not solve the problem, contact HP support.

48 Redundancy Halted Firmware Cloned

Type: Informational

Description: Both controllers must be running the same version of firmware for redundant mode. Controller Firmware Auto Cloning is complete. The system is automatically restarting the standby controller to attempt redundant mode again.

Action: None

49 Redundancy Failed Firmware Lockup

Type: Error

Description: While either attempting to enter redundant mode or already operating in redundant mode, one of the controllers encountered a critical condition resulting in a firmware lockup. Redundancy is disabled at this time.

Action:

If the storage system is currently involved in host I/O:

1. Remove the standby controller.
2. Wait 10 seconds.
3. Reinstall the controller, and be sure that it seats fully in the chassis.

If this action does not solve the problem, wait until downtime is available and do the following:

1. Power down the storage system (on page [28](#)).
2. Remove both controllers.
3. Reinstall both controllers, and be sure that they seat fully in the chassis.

If this action does not solve the problem, contact HP support.

50 Redundancy Failed Out of Memory

Type: Error

Description: While either attempting to enter redundant mode or already operating in redundant mode, one of the controllers failed to allocate required memory. Redundancy is disabled at this time.

Action:

If the storage system is currently involved in host I/O:

1. Remove the standby controller.

2. Wait 10 seconds.
3. Reinstall the controller, and be sure that it seats fully in the chassis.

If this action does not solve the problem, wait until downtime is available and do the following:

1. Power down the storage system (on page [28](#)).
2. Remove both controllers.
3. Reinstall both controllers, and be sure that they seat fully in the chassis.

If this action does not solve the problem, contact HP support.

51 Redundancy Failed I/O Request Error

Type: Error

Description: While either attempting to enter redundant mode or already operating in redundant mode, one of the controllers encountered an error while sending I/O on the communication channel between the two controllers. Redundancy is disabled at this time.

Action:

If the storage system is currently involved in host I/O:

1. Remove the standby controller.
2. Wait 10 seconds.
3. Reinstall the controller, and be sure that it seats fully in the chassis.

If this action does not solve the problem, wait until downtime is available and do the following:

1. Power down the storage system (on page [28](#)).
2. Remove both controllers.
3. Reinstall both controllers, and be sure that they seat fully in the chassis.

If this action does not solve the problem, contact HP support.

52 Redundancy Failed PCI Bus Error

Type: Error

Description: While either attempting to enter redundant mode or already operating in redundant mode, one of the controllers encountered a PCI bus error on the communication channel between the two controllers. Redundancy is disabled at this time.

Action:

If the storage system is currently involved in host I/O:

1. Remove the standby controller.
2. Wait 10 seconds.
3. Reinstall the controller, and be sure that it seats fully in the chassis.

If this action does not solve the problem, wait until downtime is available and do the following:

1. Power down the storage system (on page [28](#)).
2. Remove both controllers.
3. Reinstall both controllers, and be sure that they seat fully in the chassis.

If this action does not solve the problem, contact HP support.

53 Redundancy Failed No Second Controller

Type: Error

Description: While operating in redundant mode, one of the controllers was removed. Redundancy is disabled at this time.

Action: Reinstall the missing controller, and be sure that it seats fully in the chassis.

54 Redundancy Failed Cache DIMMs Mismatch

Type: Error

Description: The cache memory modules on two different controllers are not the same size. All cache memory modules must be the same size for redundant mode.

Action:

1. Remove the controller that has halted.
2. Replace the cache memory with the appropriately sized DIMMs.
3. Wait 10 seconds.
4. Reinstall the controller, and be sure that it seats fully in the chassis.

60 No Cache Module Found

Type: Error

Description: The controller requires at least one cache module to operate. The cache module is not present or it has failed.

Action:

1. Remove the failed controller.
2. Either add a cache module or replace the failed one.
3. Wait 10 seconds.
4. Reinstall the controller, and be sure that it seats fully in the chassis.

If this action does not solve the problem, contact HP support.

61 Dual Cache Module Size Mismatch

Type: Error

Description: The controller has two cache modules attached, but they are of different sizes. Both cache modules must be the same size.

Action:

1. Remove the failed controller.
2. Replace one of the cache modules with a different module with the correct memory.
3. Wait 10 seconds.
4. Reinstall the controller, and be sure that it seats fully in the chassis.

62 Cache Module #<n> <n>MB

Type: Informational

Description: Displays the size of the cache module inserted into the respective cache module slot.

Action: None

63 Valid Cache Data Found at Power-Up

Type: Informational

Description: Valid host data exists in the battery-backed cache memory at power-up. The controller has flushed this data to the drives.

Action: None

64 Cache Data Lost Battery Dead

Type: Informational

Description: The battery on the cache memory is no longer charged. If data existed in the cache memory, it is lost.

Action: None

65 Cache Hardware Enabled

Type: Informational

Description: The cache hardware was temporarily disabled, but it is enabled again. This message might result from insufficient charge on the batteries that are now charged to capacity.

Action: None

66 Cache Hardware Failed and Disabled

Type: Error

Description: The cache hardware has experienced a hardware failure.

Action:

If the storage system is currently involved in host I/O:

1. Remove the standby controller.
2. Wait 10 seconds.
3. Reinstall the controller, and be sure that it seats fully in the chassis.

If this action does not solve the problem, wait until downtime is available and do the following:

1. Power down the storage system (on page [28](#)).
2. Remove both controllers.

3. Reinstall both controllers, and be sure that they seat fully in the chassis.

If this action does not solve the problem, contact HP support.

67 Cache Hardware Temporarily Disabled

Type: Informational

Description: The cache memory hardware is temporarily disabled, typically because either the battery is not charged or a capacity expansion operation is occurring. After the problem is solved, the system automatically enables the cache.

Action:

- If a capacity expansion operation is occurring, wait for the process to finish.
- If the battery is not charged, allow sufficient time for the battery to charge or replace the cache module.
- If this action does not solve the problem, contact HP support.

68 Obsolete Cache Data Deleted

Type: Informational

Description: Old data that no longer belongs to any current configured volumes exists in the cache memory at power up. The controller deleted this data. This action typically results when cache modules are migrated between controllers.

Action: None

69 Cache Batteries Low, Recharging

Type: Informational

Description: The batteries on the cache module are low; the storage system is recharging the batteries.

Action: None

70 Cache Disabled No Configuration

Type: Informational

Description: The controller has disabled the cache because the cache is not configured.

Action: Use ACU to configure the cache.

71 System Halted for Cache Error

Type: Error

Description: The user has chosen to address a critical cache error condition. This message always appears after message 72 ("72 Cache Error <n> Ignore>? <=NO >=YES" on page [106](#)). Message 72 is removed from the LCD after it has accepted user input.

Action:

- Select the **NO** option to halt the controller and solve the problem.
- Select the **YES** option to erase the cache data. Operation of the controller continues normally.

Error 1.1 and 1.2: Only one cache board is in the controller, but the controller was configured with a second cache board that is missing (dual cache module configuration).

Error 2.1 and 2.2: A second cache board that contained valid data was removed from its original controller and added to this controller (dual cache module configuration).

Error 2.3: A cache board that contained valid data was removed from its original controller and added to this controller (single cache module configuration).

1. Return all cache boards to their original controllers.
2. Power up the storage systems without allowing any host I/O.
3. Wait for the controller to write cache data to the drives. This can take several minutes.
4. Power down the storage systems and relocate cache boards, as needed.

If this action does not solve the problem, contact HP support.

72 Cache Error <n> Ignore>? <=NO >=YES

Type: User Input

Description: During power up, the controller found data in the cache but could not flush the data to the drives.

One of two conditions exists:

- The data does not belong to this controller (the cache board was moved from a different controller).
- The cache data is partial or incomplete (the rest of the data is in another cache board that was removed from the controller).

This error can occur if cache boards are moved improperly.

Action:

- Select the **NO** option to halt the controller and solve the problem.
- Select the **YES** option to erase the cache data. Operation of the controller continues normally.

Error 1.1 and 1.2: Only one cache board is in the controller, but the controller was configured with a second cache board that is missing (dual cache module configuration).

Error 2.1 and 2.2: A second cache board that contained valid data was removed from its original controller and added to this controller (dual cache module configuration).

Error 2.3: A cache board that contained valid data was removed from its original controller and added to this controller (single cache module configuration).

1. Return all cache boards to their original controllers.
2. Power up the storage systems without allowing any host I/O.
3. Wait for the controller to write cache data to the drives. This can take several minutes.
4. Power down the storage systems and relocate cache boards, as needed.

If this action does not solve the problem, contact HP support.

73 Cache Hardware Batteries Missing

Type: Error

Description: The cache memory batteries are missing.

Action:

If the storage system is currently involved in host I/O:

1. Remove the standby controller.
2. Wait 10 seconds.
3. Reinstall the controller, and be sure that it seats fully in the chassis.

If this action does not solve the problem, wait until downtime is available and do the following:

1. Power down the storage system (on page [28](#)).
2. Remove both controllers.

3. Reinstall both controllers, and be sure that they seat fully in the chassis.

If this action does not solve the problem, contact HP support.

80 Replacement Drive Found Box #<n> Bay <n>

Type: Informational

Description: A SCSI drive that was previously missing or failed has been replaced with a working SCSI drive.

Action: None

81 Smart Drive Alert Box #<n>, Bay <n>

Type: Informational

Description: A SCSI drive may be close to failing. The prefailure condition was determined either by the drive firmware using SMART technology or by the controller using monitor and performance testing.

Action: Replace the failed drive or drives as soon as possible ("Recognizing hard drive failure" on page [78](#)).

82 Drive Hot Added Box #<n>, Bay <n>

Type: Informational

Description: A SCSI drive has been added to the MSA500 G2 storage system.

Action: None

83 Drive Hot Removed Box #<n>, Bay <n>

Type: Informational

Description: A SCSI drive has been removed from the MSA500 G2 storage system.

Action: None

84 Drive Failure Box #<n>, Bay <n>

Type: Informational

Description: A SCSI drive in the MSA500 G2 storage system has failed. If the drive was part of a configured volume, the state of the volume depends on the fault tolerance used.

Action: Replace the failed drive or drives as soon as possible ("Recognizing hard drive failure" on page [78](#)).

85 Bad Drive Failure Box #<n>, Bay <n>

Type: Error

Description: A SCSI drive has corrupt firmware. Continued use of this drive could result in drive failure, decreased performance, or data loss.

Action: Do one of the following:

- Update the drive firmware ("Management Agents" on page [60](#)).
- Replace the failed drive or drives as soon as possible ("Recognizing hard drive failure" on page [78](#)).

If this action does not solve the problem, contact HP support.

86 Drive Position Change Detected

Type: Informational

Description: The physical drive locations have changed for SCSI drives that constitute a configured volume within the MSA500 G2 storage system. The controller can no longer access the configured volume.

Action: None

87 Drive Position Change Invalid

Type: Informational

Description: The physical drive locations have changed for SCSI drives that constitute a configured volume within the MSA500 G2 storage system. The controller can no longer access the configured volume.

Action:

1. Power down the storage system (on page [28](#)).
2. Restore the drives to their original positions.

If this action does not solve the problem, contact HP support.

89 Invalid Volume Addition

Type: Error

Description: The controller has detected an illegal volume addition.

Action: Remove the added volume.

90 RIS Version Exceeded

Type: Error

Description: The controller has detected a version of the RIS that it does not support.

Action: Remove the added volumes.

100 Volume #<n> State OK

Type: Informational

Description: The configured volume has returned to its normal operating state. This condition typically occurs after a rebuild operation is complete.

Action: None

101 Volume #<n> State Failed

Type: Informational

Description: The controller failed the configured volume because too many physical drives have failed, exceeding the fault tolerance level. The data on the configured volume is no longer available.

Action: None

102 Volume #<n> State Interim Recovery

Type: Informational

Description: The controller failed one or more of the physical drives that constitute the configured volume. No data loss has occurred because fault tolerance is allowing data recovery.

Action: Replace the failed drive or drives as soon as possible ("Recognizing hard drive failure" on page [78](#)).

103 Volume #<n> State Rebuilding

Type: Informational

Description: The configured volume is rebuilding data on a physical drive that replaced a previously failed drive.

Action: None

104 Volume #<n> State Disabled

Type: Error

Description: The controller disabled the configured volume because too many drives that constitute the volume are missing.

Action:

1. Power down the storage system (on page [28](#)).
2. Power down all attached storage enclosures.
3. Remove and reinstall all SCSI drives, and be sure that they seat fully in their bays.
4. Check for proper connections on the cables to and from the MSA500 G2 storage system.
5. Power up the attached storage enclosures.

6. Power up the storage system (on page [27](#)).

If this action does not solve the problem, contact HP support.

105 Volume #<n> State Expansion Active

Type: Informational

Description: The configured volume is performing a volume expansion operation.

Action: None

106 Volume #<n> State Waiting to Rebuild

Type: Informational

Description: The configured volume is waiting before rebuilding data on a physical drive that replaces a previously failed drive. The rebuild may not have started yet because the controller is already performing a rebuild on another configured volume.

Action: None

107 Volume #<n> State Waiting to Expand

Type: Informational

Description: The configured volume is waiting to start a volume expansion operation. The expansion may not have started yet because another configured volume is undergoing expansion or a rebuild is occurring on the configured volume.

Action: None

108 Volume #<n> State Missing Drives

Type: Error

Description: The configured volume is unusable because too many drives that constitute the volume are missing. The controller will disable this volume.

Action:

1. Power down the storage system (on page [28](#)).
2. Power down all attached storage enclosures.
3. Remove and reinstall all SCSI drives, and be sure that they seat fully in their bays.
4. Check for proper connections on the cables to and from the MSA500 G2 storage system.
5. Power up the attached storage enclosures.
6. Power up the storage system (on page [27](#)).

If this action does not solve the problem, contact HP support.

109 Volume #<n> State Wrong Drive Replaced

Type: Error

Description: The controller recognizes drive replacement on working physical drives rather than failed drives.

Action:

1. Power down the storage system (on page [28](#)).
2. Reinstall the working drives.
3. Replace the failed drives.
4. Power up the storage system (on page [27](#)).

110 Volume #<n> Expansion Disabled

Type: Informational

Description: The controller disabled a volume expansion operation on the configured volume. This condition can result from the following:

- An ongoing rebuild operation
- Another expansion operation
- Disabled cache memory caused by a low battery

This expansion resumes after the condition has been cleared.

Action: Wait for the current operation to finish. If the condition doesn't change, replace the cache module.

111 Volume #<n> Initializing Parity

Type: Informational

Description: The controller is calculating and storing parity information for the configured volume and performance may be low until this operation is complete.

Action: None

112 Volume #<n> Rebuild Failure

Type: Error

Description: The rebuild operation on the configured volume failed.

Action: If the volume is still operating in regenerative mode, remove the replacement drive and replace it with a different new drive.

113 Volume #<n> Expansion Failure

Type: Error

Description: The volume expansion operation on the configured volume failed.

Action: Run ACU and determine the state of the volume. If the volume is still operational, reattempt the operation.

114 Volume #<n> State Deleted

Type: Informational

Description: The configured volume is deleted and no longer available. Use ACU to delete volumes.

Action: None

120 Configured Volumes #<n>

Type: Informational

Description: The controller detected the specified number of configured volumes at power up.

Action: None

121 No Volumes Detected

Type: Informational

Description: The controller did not detect configured volumes at power up.

Action: If configured volumes are expected at power up:

1. Power down the storage system (on page [28](#)).

2. Remove and reinstall all SCSI drives, and be sure that they seat fully in their bays.
3. Check for proper connections on the cables to and from the MSA500 G2 storage system.
4. Power up the storage system (on page [27](#)).

If this action does not solve the problem, contact HP support.

122 New Volumes Detected

Type: Informational

Description: Configured volumes from another controller were migrated to this controller. The controller updated the configuration information.

Action: None

123 Too Many Volumes Detected

Type: Error

Description: The controller detected more than 32 volumes (maximum supported) at power up. This condition can occur when the ACU migrates a set of volumes from one controller to a different controller that already contains configured volumes. The controller does not add the migrated volumes.

Action:

1. Remove the migrated drives.
2. Run ACU.
3. Delete any unneeded volumes until the number of existing volumes plus the number of volumes awaiting migration is equal to or less than 32 volumes.
4. Add the migrated volumes.

If this action does not solve the problem, contact HP support.

124 Spares Cleared

Type: Informational

Description: A set of volumes have been migrated from one controller to a different controller that already contains configured volumes. The migrated volumes have spares defined for them that conflict with the existing configuration. The defined spares have been deleted to allow the migration to proceed.

Action: Run ACU to reassign spare drives as needed.

125 Access Control Conflict Detected

Type: Error

Description: A set of volumes have been migrated from one controller to a different controller that already contains configured volumes. The migrated volumes have access controls defined for them that conflict with the existing configuration. The access controls have been modified to allow the migration to proceed.

Action: Run ACU to check the new access controls and modify them, if needed.

126 Access Control Resources Exceeded

Type: Error

Description: A set of volumes have been migrated from one controller to a different controller that already contains configured volumes. The migrated volumes have access controls defined for them that conflict with the existing configuration. The access controls have been modified to allow the migration to proceed.

Action: Run ACU to check the new access controls and modify them, if needed.

201 Array Controller Temperature OK

Type: Informational

Description: The controller temperature is within the normal operating range. This message appears when the temperature problem no longer exists, and it follows message 202 and/or message 203.

Action: None

202 Array Controller Overheating

Type: Error

Description: The temperature sensor on the controller indicates the controller is exceeding the normal operating range.

Action:

1. Be sure that all MSA500 G2 storage system fans are operating.
2. Replace any failed fans.
3. Be sure that all bays are populated with components or blanks.

If this action does not solve the problem, contact HP support.

203 Array Controller Overheated

Type: Error

Description: The temperature sensor on the controller indicates the controller exceeded the normal operating range.

Action:

1. Avoid hardware failure. Power down the storage system (on page [28](#)).
2. Be sure that all MSA500 G2 storage system fans are operating.
3. Replace any failed fans.

4. Be sure that all bays are populated with components or blanks.

If this action does not solve the problem, contact HP support.

204 Array Controller Disabled

Type: Error

Description: The controller is disabled because of a redundancy failure.

Action:

1. Remove the failed controller.
2. Wait 10 seconds.
3. Reinstall the controller, and be sure that it seats fully in the chassis.

If this action does not solve the problem, contact HP support.

205 Array Controller Restarting

Type: Informational

Description: The controller has completed Controller Firmware Auto Cloning and is restarting automatically.

Action: None

300 Recovery ROM Autoflash Started

Type: Informational

Description: Indicates that the controller detected that the backup recovery ROM image of the firmware is invalid and is copying the current active firmware image into the backup recovery ROM.

Action: None

301 Recovery ROM Autoflash Done

Type: Informational

Description: Indicates that the controller successfully completed the process of copying the current active firmware image into the backup recovery ROM.

Action: None

302 Recovery ROM Autoflash Failed

Type: Informational

Description: Indicates that the controller failed to copy the current active firmware image into the backup recovery ROM. Recovery ROM support is disabled.

Action:

1. Remove the failing controller.
2. Wait 10 seconds.
3. Reinstall the controller, and be sure that it seats fully in the chassis.

The controller reattempts the ROM autoflash process again.

If this action does not solve the problem, contact HP support.

303 ROM Cloning Started

Type: Informational

Description: Indicates that the two controllers in an MSA500 G2 storage system do not have the same version of firmware. Controller Firmware Auto Cloning begins.

Action: Refer to Controller Firmware Auto Cloning (on page [62](#)).

304 ROM Cloning Done

Type: Informational

Description: Indicates that the two controllers in an MSA500 G2 storage system completed the Controller Firmware Auto Cloning process.

Action: Refer to Controller Firmware Auto Cloning (on page [62](#)).

305 ROM Cloning Failed

Type: Error

Description: Indicates that the two controllers in an MSA500 G2 storage system failed the Controller Firmware Auto Cloning process.

Action:

1. Remove the failed controller.
2. Wait 10 seconds.
3. Reinstall the controller, and be sure that it seats fully in the chassis.

The controller reattempts the Controller Firmware Auto Cloning process again.

If this action does not solve the problem, contact HP support.

306 Firmware Flash Started

Type: Informational

Description: Indicates that the controller in an MSA500 G2 storage system is flashing the firmware.

Action: Do not power down the storage system until the process is complete. The process could take up to 5 minutes.

307 Firmware Flash Done

Type: Informational

Description: Indicates that the controller in an MSA500 G2 storage system completed the firmware flash process.

Action: Power down the storage system (on page [28](#)).

308 Firmware Flash Failed

Type: Error

Description: Indicates that the controller in an MSA500 G2 storage system failed the firmware flash process.

Action: Attempt the flash process again. If this action does not solve the problem, contact HP support.

309 EMU Flash Started

Type: Informational

Description: Indicates that the I/O EMU in the MSA500 G2 storage system is flashing the firmware.

Action: Do not power down the storage system until the process is complete. The process could take up to 5 minutes. If this action does not solve the problem, contact HP support.

310 EMU Flash Done

Type: Informational

Description: Indicates that the I/O EMU in the MSA500 G2 storage system completed the firmware flash process.

Action: Power down the storage system (on page [28](#)).

311 EMU Flash Failed

Type: Error

Description: Indicates that the I/O EMU in the MSA500 G2 storage system failed the firmware flash process.

Action: Attempt the flash process again. If this action does not solve the problem, contact HP support.

400 Storage Box #<n> Fan OK

Type: Informational

Description: The specified storage system indicates that one of its previously failed or degraded fans is now operating normally.

Action: None

401 Storage Box #<n> Fan Failed

Type: Error

Description: The specified storage system indicates that one of its fans has failed. The storage system and any devices in it may now be susceptible to overheating if corrective action is not taken.

Action:

1. Be sure that all MSA500 G2 storage system fans are operating.
2. Replace any failed fans.

If this action does not solve the problem, contact HP support.

402 Storage Box #<n> Fan Degraded

Type: Error

Description: The specified storage system indicates that one of its fans is not operating at full efficiency. The fan may eventually fail.

Action:

1. Be sure that all MSA500 G2 storage system fans are operating.
2. Replace any failed fans.

If this action does not solve the problem, contact HP support.

403 Storage Box #<n> Fan Hot Inserted

Type: Informational

Description: The specified storage system indicates that a fan was added.

Action: None

404 Storage Box #<n> Fan Hot Removed

Type: Informational

Description: The specified storage system indicates that a fan was removed.

Action: None

405 Storage Box #<n> Temperature OK

Type: Informational

Description: The temperature sensor in the specified storage system indicates that the temperature is in the normal operating range.

Action: None

406 Storage Box #<n> Overheating

Type: Error

Description: The temperature sensor in the specified storage system indicates that the temperature is exceeding the normal operating range.

Action:

1. Avoid hardware failure. Power down the storage system (on page [28](#)).
2. Be sure that all MSA500 G2 storage system fans are operating.
3. Replace any failed fans.
4. Be sure that all bays are populated with components or blanks.

If this action does not solve the problem, contact HP support.

407 Storage Box #<n> Overheated

Type: Error

Description: The temperature sensor in the specified storage system indicates that the temperature exceeded the normal operating range.

Action:

1. Avoid hardware failure. Power down the storage system (on page [28](#)).
2. Be sure that all MSA500 G2 storage system fans are operating.
3. Replace any failed fans.
4. Be sure that all bays are populated with components or blanks.

If this action does not solve the problem, contact HP support.

408 Storage Box #<n> Power Supply OK

Type: Informational

Description: The specified storage system indicates that one of its previously failed power supplies is now operating normally.

Action: None

409 Storage Box #<n> Power Supply Failed

Type: Error

Description: The specified storage system indicates that one of its power supplies has failed.

Action:

1. Check all power supplies for damage.
2. Replace any failed power supplies.

If this action does not solve the problem, contact HP support.

410 Storage Box #<n> Power Supply Added

Type: Informational

Description: The specified storage system indicates that a power supply was added.

Action: None

411 Storage Box #<n> Power Supply Removed

Type: Informational

Description: The specified storage system indicates that a power supply was removed.

Action: None

412 Storage Box #<n> EMU Not Responding

Type: Error

Description: The specified storage system is not responding to commands.

Action:

1. Be sure that the MSA500 G2 storage system is powered up.
2. Be sure that all cables are connected securely.
3. Power down the MSA500 G2 storage system.
4. Power up the MSA500 G2 storage system.

If this action does not solve the problem, contact HP support.

413 Storage Box #<n> EMU Version <version>

Type: Informational

Description: Displays the version of the firmware running on the I/O EMU. This display only applies to the internal I/O EMU of the storage system. The controller does not display versions for externally connected storage boxes.

Action: None

500 Initializing PCI Subsystem

Type: Informational

Description: The controller PCI subsystem is initializing as part of the power-up sequence.

Action: None

501 PCI Subsystem Hardware Failure

Type: Error

Description: The controller PCI subsystem encountered a critical error during the power-up sequence.

Action:

1. Remove the failed controller.
2. Wait 10 seconds.
3. Reinstall the controller, and be sure that it seats fully in the chassis.

If this action does not solve the problem, contact HP support.

502 PCI Bridge ASIC Self Test Failure

Type: Error

Description: The controller PCI bridge ASIC has encountered a critical error during the power-up sequence.

Action:

1. Remove the failed controller.
2. Wait 10 seconds.
3. Reinstall the controller, and be sure that it seats fully in the chassis.

If this action does not solve the problem, contact HP support.

513 Uncorrected ECC Memory Error Seen

Type: Error

Description: The controller has detected an uncorrectable error in the ECC memory on the memory cache board.

Action: Remove the failed controller. Replace the cache module DIMM.

518 <name> Connection Lost

Type: Error

Description: The named connection has been lost.

Action: Check SCSI connections to the server. Also, the controller may have a failed SCSI controller chip.

519 <name> Connection Restored

Type: Error

Description: The named connection has been restored.

Action: None

520 Unknown I/O Module Detected

Type: Error

Description: The controller has detected an I/O module that is not responding with a known, good identifier.

Action: Replace the I/O module.

521 ULTRA 3 I/O Module Detected

Type: Error

Description: The controller has detected an Ultra3 I/O module.

Action: Replace the I/O module.

Regulatory compliance notices

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Regulatory compliance identification numbers

For the purpose of regulatory compliance certifications and identification, this product has been assigned a unique regulatory model number. The regulatory model number can be found on the product nameplate label, along with all required approval markings and information. When requesting compliance information for this product, always refer to this regulatory model number. The regulatory model number is not the marketing name or model number of the product.

Federal Communications Commission notice

Part 15 of the Federal Communications Commission (FCC) Rules and Regulations has established Radio Frequency (RF) emission limits to provide an interference-free radio frequency spectrum. Many electronic devices, including computers, generate RF energy incidental to their intended function and are, therefore, covered by these rules. These rules place computers and related peripheral devices into two classes, A and B, depending upon their intended installation. Class A devices are those that may reasonably be expected to be installed in a business or commercial environment. Class B devices are those that may reasonably be expected to be installed in a residential environment (for example, personal computers). The FCC requires devices in both classes to bear a label indicating the interference potential of the device as well as additional operating instructions for the user.

FCC rating label

The FCC rating label on the device shows the classification (A or B) of the equipment. Class B devices have an FCC logo or ID on the label. Class A devices do not have an FCC logo or ID on the label. After you determine the class of the device, refer to the corresponding statement.

Class A equipment

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at personal expense.

Class B equipment

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit that is different from that to which the receiver is connected.
- Consult the dealer or an experienced radio or television technician for help.

Declaration of conformity for products marked with the FCC logo, United States only

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

For questions regarding this product, contact us by mail or telephone:

- Hewlett-Packard Company
P. O. Box 692000, Mail Stop 530113
Houston, Texas 77269-2000
- 1-800-HP-INVENT (1-800-474-6836). (For continuous quality improvement, calls may be recorded or monitored.)

For questions regarding this FCC declaration, contact us by mail or telephone:

- Hewlett-Packard Company
P. O. Box 692000, Mail Stop 510101
Houston, Texas 77269-2000
- 1-281-514-3333

To identify this product, refer to the part, series, or model number found on the product.

Cables

Connections to this device must be made with shielded cables with metallic RFI/EMI connector hoods in order to maintain compliance with FCC Rules and Regulations.

Modifications

The FCC requires the user to be notified that any changes or modifications made to this device that are not expressly approved by Hewlett-Packard Company may void the user's authority to operate the equipment.

European Union regulatory notice

This product complies with the following EU Directives:

- Low Voltage Directive 73/23/EEC
- EMC Directive 89/336/EEC

Compliance with these directives implies conformity to applicable harmonized European standards (European Norms) which are listed on the EU Declaration of Conformity issued by Hewlett-Packard for this product or product family.

This compliance is indicated by the following conformity marking placed on the product:



This marking is valid for non-Telecom products and EU harmonized Telecom products (e.g. Bluetooth).



This marking is valid for EU non-harmonized Telecom products.

*Notified body number (used only if applicable—refer to the product label)

Canadian notice (Avis Canadien)

Class A equipment

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Class B equipment

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Japanese notice

ご使用になっている装置にVCCIマークが付いていましたら、次の説明文をお読み下さい。

この装置は、情報処理装置等電波障害自主規制協議会（VCCI）の基準に基づくクラスB情報技術装置です。この装置は、家庭環境で使用することを目的としていますが、この装置がラジオやテレビジョン受信機に近接して使用されると、受信障害を引き起こすことがあります。
取扱説明書に従って正しい取り扱いをして下さい。

VCCIマークが付いていない場合には、次の点にご注意下さい。

この装置は、情報処理装置等電波障害自主規制協議会（VCCI）の基準に基づくクラスA情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

BSMI notice

警告使用者:

這是甲類的資訊產品，在居住的環境中使用時，可能會造成射頻干擾，在這種情況下，使用者會被要求採取某些適當的對策。

Korean notice A&B

Class A equipment

A급 기기 (업무용 정보통신기기)

이 기기는 업무용으로 전자파적합등록을 한 기기이오니 판매자 또는 사용자는 이 점을 주의하시기 바라며, 만약 잘못판매 또는 구입하였을 때에는 가정용으로 교환하시기 바랍니다.

Class B equipment

B급 기기 (가정용 정보통신기기)

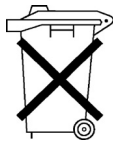
이 기기는 가정용으로 전자파적합등록을 한 기기로서 주거지역에서는 물론 모든지역에서 사용할 수 있습니다.

Battery replacement notice



WARNING: The computer contains an internal lithium manganese dioxide, a vanadium pentoxide, or an alkaline battery pack. A risk of fire and burns exists if the battery pack is not properly handled. To reduce the risk of personal injury:

- Do not attempt to recharge the battery.
- Do not expose the battery to temperatures higher than 60°C (140°F).
- Do not disassemble, crush, puncture, short external contacts, or dispose of in fire or water.



Batteries, battery packs, and accumulators should not be disposed of together with the general household waste. To forward them to recycling or proper disposal, please use the public collection system or return them to HP, an authorized HP Partner, or their agents.

For more information about battery replacement or proper disposal, contact an authorized reseller or an authorized service provider.

Taiwan battery recycling notice

The Taiwan EPA requires dry battery manufacturing or importing firms in accordance with Article 15 of the Waste Disposal Act to indicate the recovery marks on the batteries used in sales, giveaway or promotion. Contact a qualified Taiwanese recycler for proper battery disposal.



Power cord statement for Japan

製品には、同梱された電源コードをお使い下さい。
同梱された電源コードは、他の製品では使用出来ません。

Electrostatic discharge

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Preventing electrostatic discharge

To prevent damaging the system, be aware of the precautions you need to follow when setting up the system or handling parts. A discharge of static electricity from a finger or other conductor may damage system boards or other static-sensitive devices. This type of damage may reduce the life expectancy of the device.

To prevent electrostatic damage:

- Avoid hand contact by transporting and storing products in static-safe containers.
- Keep electrostatic-sensitive parts in their containers until they arrive at static-free workstations.
- Place parts on a grounded surface before removing them from their containers.
- Avoid touching pins, leads, or circuitry.
- Always be properly grounded when touching a static-sensitive component or assembly.

Grounding methods to prevent electrostatic discharge

Several methods are used for grounding. Use one or more of the following methods when handling or installing electrostatic-sensitive parts:

- Use a wrist strap connected by a ground cord to a grounded workstation or computer chassis. Wrist straps are flexible straps with a minimum of 1 megohm ± 10 percent resistance in the ground cords. To provide proper ground, wear the strap snug against the skin.
- Use heel straps, toe straps, or boot straps at standing workstations. Wear the straps on both feet when standing on conductive floors or dissipating floor mats.
- Use conductive field service tools.
- Use a portable field service kit with a folding static-dissipating work mat.

If you do not have any of the suggested equipment for proper grounding, have an authorized reseller install the part.

For more information on static electricity or assistance with product installation, contact an authorized reseller.

Specifications

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Environmental specifications

| Temperature range* | Specification |
|-------------------------------------|--------------------------------|
| Operating | 10°C to 35°C (50°F to 95°F) |
| Shipping | -40°C to 70°C (-40°F to 158°F) |
| Maximum wet bulb temperature | 28°C (82.4°F) |
| Relative humidity (noncondensing)** | Specification |
| Operating | 10% to 90% |
| Non-operating | 5% to 95% |

* All temperature ratings shown are for sea level. An altitude derating of 1°C per 300 m (1.8°F per 1,000 ft) to 3048 m (10,000 ft) is applicable. No direct sunlight allowed.

** Storage maximum humidity of 95% is based on a maximum temperature of 45°C (113°F). Altitude maximum for storage corresponds to a pressure minimum of 70 KPa.

Dimensions and weight

| Parameter | Value |
|------------------------------|-------------------|
| Height | 17.5 cm (6.9 in) |
| Depth | 52.1 cm (20.5 in) |
| Width | 48.3 cm (19.0 in) |
| Weight (no drives installed) | 22.7 kg (50 lb) |

Power specifications

| Parameter | Value |
|--|--------------------|
| Rated input voltage | 100 VAC to 240 VAC |
| Rated input frequency | 50 Hz to 60 Hz |
| Rated input current | 7.35 A Max |
| Rated input power | 641 W * |
| BTUs per hour | 2187 * |
| Rated steady-state power | 377 W |
| Maximum peak power | 681 W |
| Acoustic noise (LWAdc bels and LpAm dBA) | |
| Idle | <6.9 and 53 |
| Fixed disk (random writes) | <7.3 and 54 |
| * Input power and heat dissipation specifications are maximum values and apply to worst-case conditions at a full-rated power supply load. The power/heat dissipation for each installation varies depending on the equipment configuration. | |

Technical support

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Before you contact HP

Be sure to have the following information available before you call HP:

- Technical support registration number (if applicable)
- Product serial number
- Product model name and number
- Applicable error messages
- Add-on boards or hardware
- Third-party hardware or software
- Operating system type and revision level

HP contact information

For the name of the nearest HP authorized reseller:

- In the United States, call 1-800-345-1518.
- In Canada, call 1-800-263-5868.
- In other locations, refer to the HP website (<http://www.hp.com>).

For HP technical support:

- In North America:

- Call 1-800-HP-INVENT (1-800-474-6836). This service is available 24 hours a day, 7 days a week. For continuous quality improvement, calls may be recorded or monitored.
- If you have purchased a Care Pack (service upgrade), call 1-800-633-3600. For more information about Care Packs, refer to the HP website (<http://www.hp.com>).
- Outside North America, call the nearest HP Technical Support Phone Center. For telephone numbers for worldwide Technical Support Centers, refer to the HP website (<http://www.hp.com>).

Acronyms and abbreviations

ACU

Array Configuration Utility

ADG

Advanced Data Guarding (also known as RAID 6)

ADU

Array Diagnostics Utility

ASIC

application specific integrated circuit

ASR

Automatic Server Recovery

CPQONLIN

NetWare Online Array Configuration Utility

DDR

double data rate

DMA

direct memory access

ECC

error checking and correcting

EMU

environmental monitoring unit

HBA

host bus adapter

I2C

inter-integrated circuit

IEC

International Electrotechnical Commission

KVM

keyboard, video, and mouse

LCD

liquid crystal display

LED

light-emitting diode

LVD

low-voltage differential

NEMA

National Electrical Manufacturers Association

NFPA

National Fire Protection Association

NIC

network interface controller

NLM

NetWare Loadable Module

NVRAM

non-volatile memory

ORCA

Option ROM Configuration for Arrays

PDU

power distribution unit

POST

Power-On Self Test

RIS

reserve information sector

ROM

read-only memory

SA

Smart Array

SE

single-ended

SIM

Systems Insight Manager

SMART

self-monitoring analysis and reporting technology

SSP

Selective Storage Presentation

TMRA

recommended ambient operating temperature

UPS

uninterruptible power system

VHDCI

very high density cable interconnect

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